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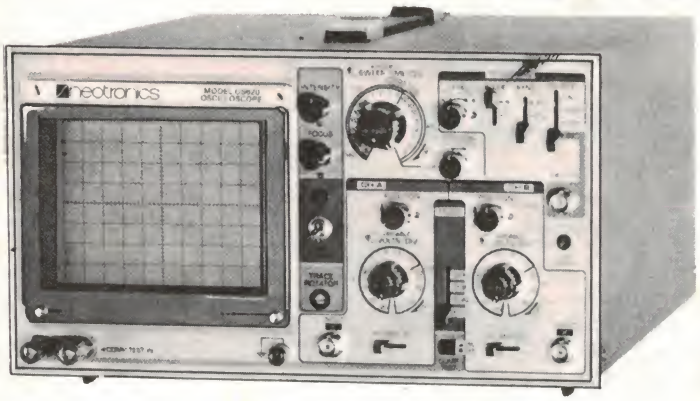

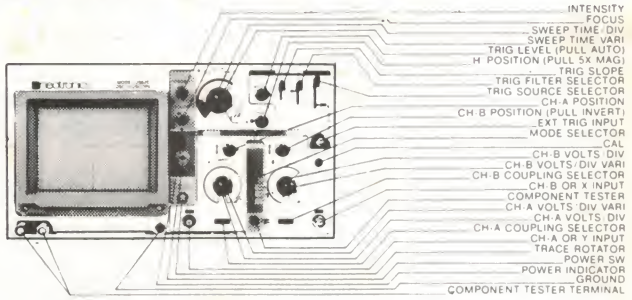

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	Neotronics OS620	Hitachi V212	TRIO 1560
Bandwidth	20MHz	20MHz	15MHz
Flat Screen with internal graticule	Yes	Yes	No
Probes	Included	$28 each	$33 each
Component tester	Yes	N/A	N/A
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COMMENT

Roger Harrison
Editor

THERE HAVE BEEN MASSIVE STRIDES in computer hardware and software development in recent years, powered by a burgeoning market demanding ever more sophistication and power and ever more 'user friendliness' (to use the trade's jargon). What the hardware/software designers are aiming at is to reduce, or strip away, the requirement for 'computer knowledge' in users or potential users. An entirely laudable aim. Just as one needn't have a mechanical engineering background to be able to drive a car, one needn't have a computer systems engineering background to be able to use a modern computer.

Standing back a little and looking at where the industry has been, I think that point was reached some time ago and the industry is rushing headlong past the goal, unrealising.

In the main, computers and their software are no longer 'unfriendly' or difficult to use, no programming ability is necessary. What *does* make *many* computers difficult to use is their documentation. Some of our staff and correspondents have had things to say on this subject over the years, varying from guarded praise to scathing condemnation. It's unfortunate, but I think that, while the state of the art has moved ahead enormously in hardware and software, it remains static when it comes to documentation. There are some specific exceptions, but all too few. Too much seems to be written in some language other than plain English; though the words are recognisable, the meaning is not.

I think the industry should be now not looking to its laurels, nor the way ahead, but introspectively, focussing on the documentation delivered with their product.

If the blind lead the blind, both shall fall into the ditch.
— St. Mathew

NEXT MONTH

APPLE'S MACINTOSH — REIGNS SUPREME?

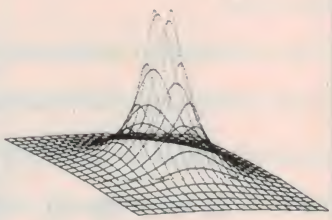
Apple launched their "third generation" computer on a slightly prepared public late in January. Will it lead Apple and the computer industry behind them into the next computer revolution? Collyn Rivers reports.

PROJECT 340 VEHICLE SECURITY ALARM

This alarm does not rely on interior lights being activated by a door opening to trip the alarm. It uses 'resonance' sensors to tell the circuitry your vehicle's being tampered with! It features three delays — exit, entry and alarm length before resetting. The alarm is armed in an unusual way so you can still protect the vehicle, even though you've left it in a parking station and the keys with the attendant.

6802-BASED MICROCONTROLLER

A microprocessor with a bit of ROM, a bit of RAM and some I/O lines can do all sorts of things. This project, based on the 6802, forms the basis of a whole series of controller projects. Remember the ETI-650 STAC Timer? There's an application, for one.



3D PLOTTING ON THE MICROBEE

How to plot three-dimensional graphs on-screen and to a printer using your Microbee computer. Simple, but smart! Excellent results, too.

Although these articles are in an advanced state of preparation, circumstances may affect the final content. However, we will make every attempt to include all features mentioned here.

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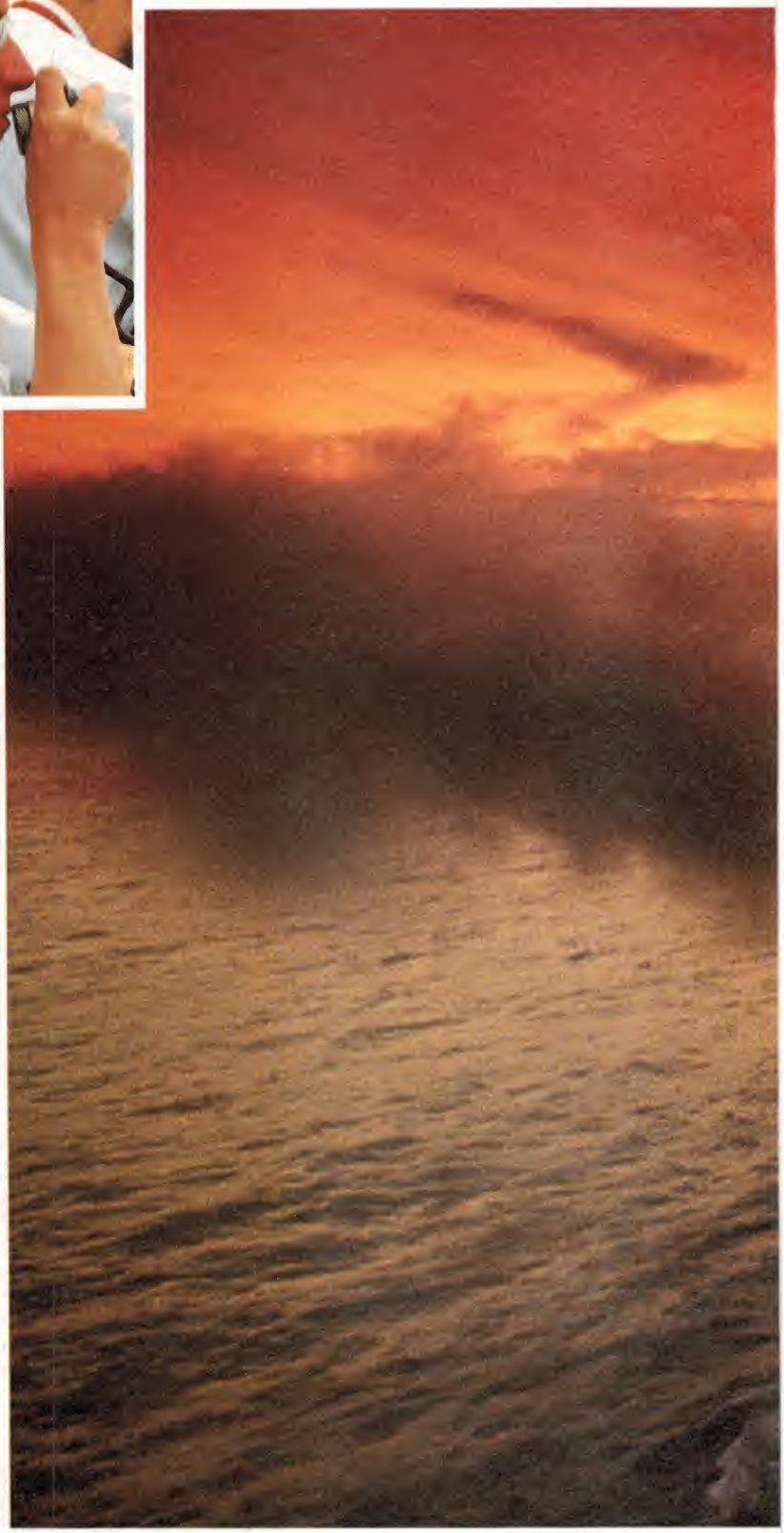
Straight sail



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So, if you want more than a degree maybe the Navy can offer you straight sailing into a career.

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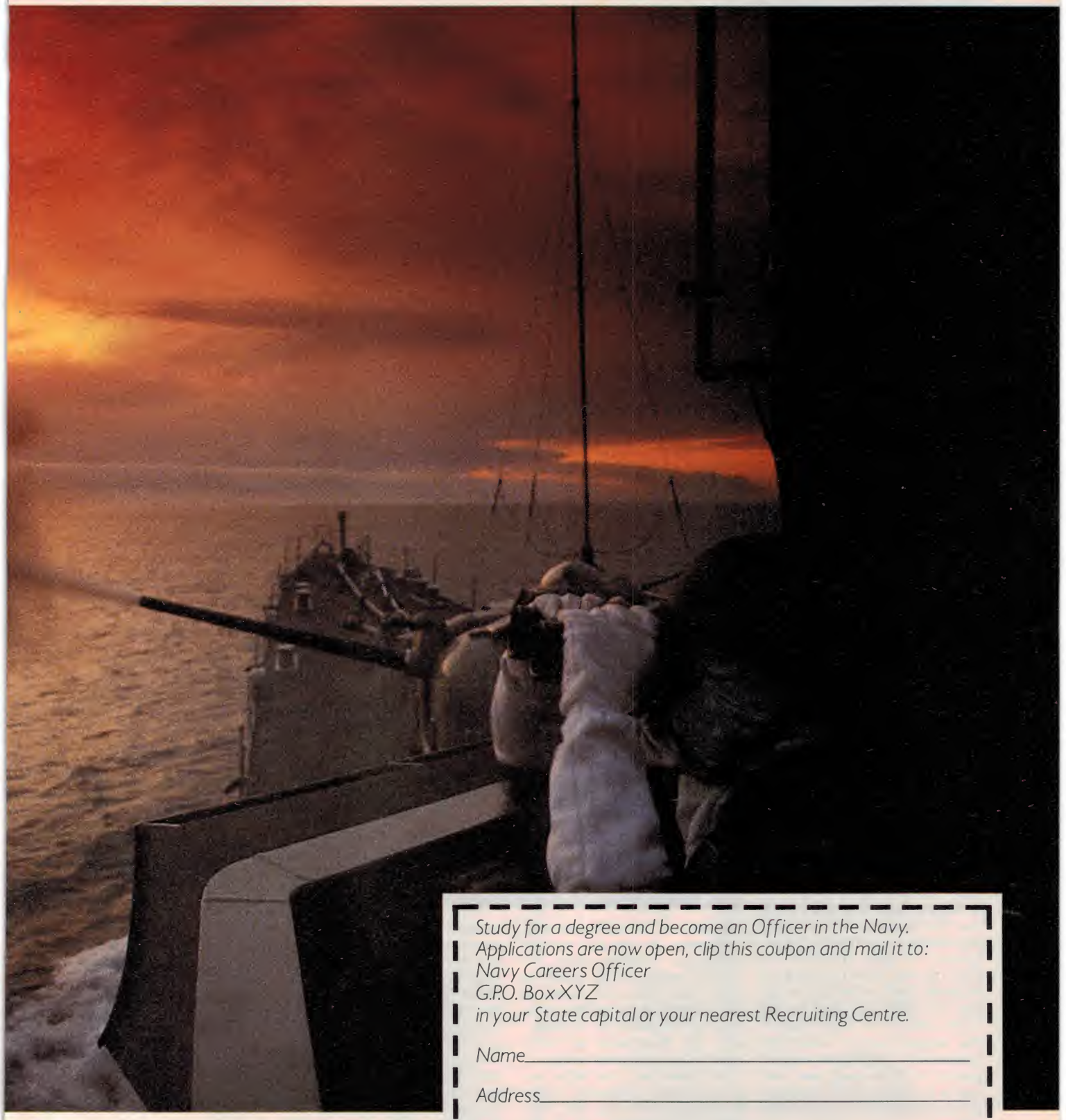

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enough?

SATELLITE TRIALS FOR ANTARCTICA

A satellite communications Earth station is being set up at the Australian base at Mawson in Antarctica in order to assess the potential of satellite communications to meet future needs of Australian National Antarctic Research Expeditions (ANARE) communications needs.

Trials of the system are to be conducted between Mawson and Australia this year. An investigation recently carreid out by the Antarctic Division of the Department of Science has shown that existing communications networks between Australia and Antarctica are inadequate and unreliable (a fact well-known to ex-expeditioners — Ed.).

It is estimated that most of the equipment currently used at the stations will need replacing in two or three years, and an urgent assessment of future demands and systems is required.

At the present time communications between Australia, her Antarctic stations and expedition ships at sea, are carried out using high frequency radio links. These links provide the sole means of radio communication, and are often severely effected by disturbances in the Earth's ionosphere.

In order to evaluate the suitability of satellite communications, the Antarctic Division, which is responsible for ANARE communication links, has decided to purchase an Inmarsat ground station.

The Inmarsat system has three satellites in geostationary orbit 36 000 km above the equator over the Atlantic, Indian and Pacific Oceans.

Mawson tests will use the Indian Ocean satellite, which will be some 13° above the horizon almost due north of the station.

This satellite's permanent control stations are at Eik in Norway and Yamaguchi in southern Japan. There are no Inmarsat control stations in Australia.

Communications traffic from Mawson will travel to the satellite, down to the Japanese station, then on to Australia via either an undersea cable, or the Intelsat satellite system to a ground station in Ceduna, South Australia. On reaching Australia, traffic will be patched into the national communications network.

The Inmarsat facility will provide a single communications channel which can be used at any time day or night for either telephone, telex, facsimile, or data transmission. This will allow an adequate evaluation of satellite communications to be made.

NEW PRESIDENT FOR A.E.I.A.

The Managing Director of Plessey Pacific Pty Ltd, Mr Bruce Goddard has been appointed the new president of the Australian Electronics Industry Association (A.E.I.A.)

He succeeds Mr Allen Deegan, Chairman and Managing Director of Standard Telephones & Cables Pty Limited, who did not seek Presidential reelection but will remain on the Board of Directors.

Newly-elected Vice-President of the association is Mr Cornelis Bossers, Managing Director of Philips Industries Holding Ltd.

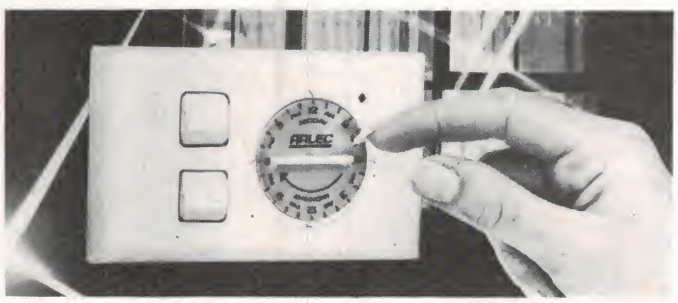
Other executive appointments made at the Annual General Meeting were: *Telecommunications and Defence Division:* Chairman, Mr Peter Lane, (Standard Telephones & Cables Pty Ltd); Vice-chairman, Mr Arthur Gabb (Amalgamated Wireless Australasia Ltd). *Components Division:* Chairman, Mr Bob Gibson (Morris Productions Pty Ltd); Vice-chairman, Mr Chris Tyree (Amtron Tyree Pty Ltd). *Mobile Radio Division:* Chairman, Mr Terry Stanley (Motorola Electronics Aust. Pty Ltd); Vice-chairman, Mr Ian McKenzie (Philips Industries Holdings Ltd).

PROGRAMMABLE SECURITY SWITCH

The new Arlec PC700 Security Switch can be programmed to turn lights on and off up to 48 times each day to give a natural 'at home' appearance to a dwelling and act as a deterrent to burglars.

To further confuse and discourage burglars the Arlec Security Switch has a built-in variability feature that automatically turns the lights on and off at slightly different times each day. Furthermore it is possible to simulate the normal 'at home' pattern of light operation by allowing the security switch to program itself according to the way the lights are used in the home over a 24 hour period. The integral memory stores the information about this normal pattern of light usage and will repeat it continuously whenever the householders are away from home.

The security switch is designed for wall mounting and can replace existing wall mounted



switches or be used in new installations. It can also replace architrave switches where the present wiring can be easily diverted into the wall cavity. It will control lamp globes to a total of 500 watts but is unsuitable for fluorescent or other types of gas discharge lamps.

In normal use, the lights can be controlled manually simply by pressing the time dial. This acts as the switch to turn the lights on or off without disturbing the preset time selections stored in the security switch's memory, which will remain effective until they are deliberately changed to another sequence by the owner. The switch has a current back-up feature to provide at least five minutes retention of memory in the event of mains power failures.

It also combines the convenience of automatic lighting control with the ability to make savings in electricity costs. For example, the programmed switch will remember to turn off lights that may have been left on inadvertently and can be made to turn lights on at the right time to greet guests, or welcome the returning household following a night out.

Further information on the PC700 Security Switch is available from **Arlec Pty Ltd, 30 Lexton Road, Box Hill Vic 3128. (03)840-1222.**

BRITISH ROBOT CONFERENCE

Industrial robotics experts are invited to submit papers to the British Robot Association (BRA) for its 7th Annual Conference to be held in Cambridge, eastern England from 14-16 May 1984.

The conference contributes to the advancement of robot technology in Britain and overseas by providing an international forum to discuss technological advancement. Presentations dealing with industrial case-studies and experience of practical applications are welcome, says BRA.

Topics for discussion include assembly and machine transfer, robot welding and design, programming, economics, human factors, safety, robot handling applications and mangement.

To date, papers have been received from Britain, the United States, Germany, France, Finland and Bulgaria. These, together with any new contributions will be of benefit to those already involved in the manufacture or use or robots as well as others who wish to increase productivity and efficiency, says BRA.

Authors abstracts — about 100 words — should be sent to **The Conference Director, BRA 7, British Robot Assocaition, 28-30 High Street, Kempston, Bedford, England, MK42 7AJ.**

NEW STANDARDS

The Standards Association of Australia has published a new standard on fixed capacitors for use in electronic equipment specifically on fixed polystyrene film dielectric dc capacitors with thin metal foil electrodes. It is identical with IEC 384-7 (1978) on that type of capacitor.

The purpose of this standard (AS 1541.2) is to establish preferred ratings and characteristics. Test severities and performance requirements for the type of capacitor are given for appropriate test procedures selected from AS 1541, Part 1, the generic standard for capacitors for use in electronic equipment.

Copies of AS 1541.2 can be purchased from any SAA office at a cost of $11.40 plus $2.40 postage and handling charge.

The SAA is also seeking comment on a proposed standard, DR 83247, for stablised power supplies having on ac output.

Stabilised power supplies are generally complex units and subject to variables such as temperature, input voltage and load. The variation in performance because of these variables are specified and this should result in the rationalisation of design, construction and performance requirements.

The draft does not cover power supplies for electrical measurement equipment. It includes the electrical performance requirements and nominates the physical dimensions to be listed when specifying a unit.

Test methods covering the stabilized output quantity and electromagnetic interference are included.

Attention is drawn to the fact that this is a draft only and liable to alteration in light of comment received.

For information telephone **(02)929-6022 or any state office.**

NOTES & ERRATA

Project 412, October 1983: The linking for dot/bar mode is shown incorrectly on the circuit and component overlay. For a dot mode display, link pins 9 and 11 (as per the photograph of the board); for the bar mode, link pin 9 to the positive supply.

Upgrading the ETI-668 EPROM Programmer, January 1984: Two connections to the 4PDT switch have been interchanged. Looking at the wiring diagram on page 70, the two upper and lower right hand wires have been transposed. The upper one says "PIN 7 PERSONALITY SKT" but should go to R14/15 — SW2b, the lower one says "R14/15 — SW2b" and should go to pin 7 of the personality socket.

Project 676, Microbee RS232er, February 1984: The pinout for the transistors, shown on page 65, is all screwed up. Use the pinout on page 111.

Project 274, Damn Fast NiCad Charger, February 1984: Figure 2 shows the battery negative connected to the heatsink. It should be insulated from it. The BYX/200L diode cathode connects to the collector of Q4/Q5 and R1/LED1 via the heatsink, not the wires shown.

LONDON LAB SHOW

The Department of Trade is seeking companies manufacturing scientific, medical and laboratory equipment to participate in the 1984 London Laboratory Show. Participation in the show, to be held at the Barbican Centre from 4-6 September, will develop Australia's image as a manufacturer of world class high technology equipment.

Australian participation in Fairs covering similar products — Semlab UK 1981 and Mesucora France 1982 — has been very successful with exhibitors receiving initial orders of $200,000 and $938,000 respectively.

The product coverage includes scientific educational, medical and industrial equipment; services and supplies; sensors and back-up systems; medical electronics; analytical and biochemical research in instrumentation; electronic measuring and testing equipment; measurement control systems and instrumentation.

The Scientific Instrument Manufacturers' Association will run a major analytical conference concurrently with the Laboratory Show.

Australian laboratory equipment manufactuers seeking information on participation should contact the **Promotions Officer, Ian French, Department of Trade, Canberra ACT 2600. (062) 72-25115.**

ARLEC'S MINI ELECTRIC TOOL

Designed in Australia, the Arlec Supertool Model No. ET571 is a compact, precision power tool which has a multitude of uses in and around the home, the office, factory, workshop etc. It is described as 'ideal' for miniature and electronic engineering, educational projects and drawing office work.

Particular emphasis has been placed on the design of the casing to ensure optimum balance and ease of handling, with weight kept to a minimum. The on/off switch provides feather-touch stop/start control with a switch lock for continuous running.

The robust 12 watt motor operates at 10 000 revolutions per minute and is powered via an SEC approved plugpack adaptor.

The unit is supplied with eight tools, six eraser sticks and a collet chuck with five collets for a variety of tasks including drilling, shaping, cleaning grinding, and erasing. It can also be used with supplementary bits and cutters for milling, sanding, polishing, cutting and the superior continuous-line system of engraving.

Draughtsmen and graphic artists should find it invaluable as it is excellent for erasing ink and pencil lines quickly and cleanly from drawings, tracings, photocopies and dyeline prints.

Electronics designers and hobbyists use it as a high speed printed-circuit board drill and cutter. Handymen utilise it for small drilling, sanding and polishing jobs including using the unit to sharpen other tools.

Further information is available from **Arlec Pty Ltd, 30 Lexton Road, Box Hill Vic. 3128.**

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ELECTRONICS TO JAPAN?

Sydney designers and manufacturers of computer-based musical instruments, Fairlight Instruments Pty Ltd, was one of 18 firms to win last year's Export Awards for Outstanding Achievement.

The annual awards, sponsored by the Confederation of Australian Industry and the Department of Trade since 1963, are a recognition of significant achievement in skill, enterprise and initiative in the export field.

Presented by the Minister for Industry and Commerce, Senator John Button, the award was accepted for the company by Research and Development Officer, Mr P. Vogel, at a presentation ceremony in Canberra on 2 December.

Fairlight Instruments claims a world first in the marketing of its technologically innovative microcomputer-based, multivoice, sound-producing system, the

Fairlight Computer Musical Instrument (CMI).

Accepted by leading international musicians, the CMI has achieved impressive export growth, up from sales of $457 000 in its first year of production (1979-80) to $1.6 million last financial year.

An arrangement with Japan's Matsushita to launch the product there, earned the firm an initial $250 000. Other major sales have been in the USA, Britain and Europe.

World publicity was a significant success factor, much of it generated by trade show participation and advertising and promotional tours assisted by Trade Commissioners and export incentive grants.

The CMI was developed with the aid of an Industrial Research and Development Grant.

TV CHANNEL SPACING STANDARD CHANGE

The Minister for Communications, Mr Michael Duffy, announced in December that the existing official standard of 8 MHz spacing for the carriage of television signals in the UHF band would be changed to 7 MHz.

Mr Duffy said his decision would allow for more productive use of the spectrum which was a limited physical resource. The decision followed detailed consultation with the broadcasting industry and television receiver manufacturers, according to the minister's office. It would have no detrimental effect on the industry and would not cause any increase in the price of receivers, he claimed.

The existing standard of 8 MHz spacing was created in 1976 by the old Australian Broadcasting Control Board which had initially favoured 8 MHz spacing for UHF television services and 7 MHz for the more traditional VHF band. This band was becoming congested and as a result, the UHF band would increasing be used in Australia for the future expansion of television services.

Apart from enabling the planners to make more efficient use of UHF, adoption of 7 MHz spacing would also allow development of a national UHF television plan to proceed. The relevant technical standard for Australian television services would be altered in accordance with the decision, Mr Duffy said.

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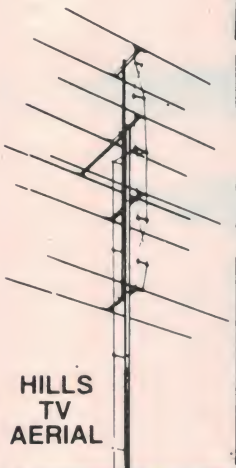

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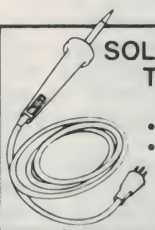

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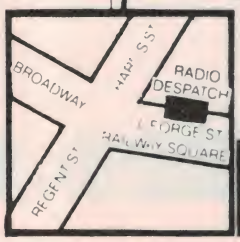

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W5LFL VK1ORR

A group of Canberra radio amateurs set out to prove that amateur radio could provide viable backup communications for manned space flights.
Using 144 MHz equipment, they made an historic contact between Owen Garriott, W5LFL, aboard the Space Shuttle Columbia that flew in late November to early December last year, patching him through to the Johnston Space Centre in Houston (USA). This is their story.

MORE AMATEURS IN SPACE?

AMATEUR RADIO may well be welcome aboard future Space Shuttle flights as a direct result of the success of Dr Owen Garriott's operations on the STS-9 mission.

Although reports did not specifically mention the VK10RR operation, its success has undoubtedly had some influence. The general amateur contacts were achieved in Garriott's 'spare time'. At a post-flight press conference on 19 December, Garriott said, "As with most hams on the ground, you have the opportunity to do that kind of work only in your spare time. That's the way we did it on board as well.

"In the hours I managed to find time for it, I talked with some 300 hams in various parts of the world, principally in the US, but also a good many in Europe, and other people scattered all over the face of the globe.

"Most of the contacts were by phone (voice), some on CW (morse code). These were all logged and will be acknowledged now that we are back here on the ground."

Carl Smith, W0BWJ, President of the American Radio Relay League, was on hand at the press conference to congratulate Dr Garriott and he expressed the hope that it will be possible to have more licensed amateur radio operators on board future Space Shuttle missions in order to prove that the amateurs' capability of providing backup and emergency communications is real.

The public relations success of W5LFL's operation cannot be denied. NASA, in need of favourable public exposure, showed that ordinary people can become involved in the space program.

(Item courtesy *Westlink Report* — Ed.)

Shuttle-to-Houston via amateur radio

P. G. Clark VK2KPG
for the VK10RR amateur group

WHEN it was announced that Dr Owen Garriott would operate as W5LFL from the Space Shuttle "Columbia" during the STS-9 mission, a great deal of interest was generated within the amateur fraternity worldwide. W5LFL used a hand-held transceiver in the two metre amateur band (144-148 MHz). This was the first time that an amateur station had been operated from an orbiting manned spacecraft.

The interest in this expansion of VHF amateur radio was shown by an active group working at the Orroral Valley NASA Space Tracking Station, situated in the Gudgenby Nature Reserve in the southern part of the Australian Capital Territory. The Orroral Tracking Station supports the Space Shuttle missions by providing tracking, telemetry and voice contact whenever the orbiter is in range. The amateurs at Orroral Valley are part of the specialist teams established to meet satellite tracking requirements. After discussion, this group decided to investigate the possibility of establishing an amateur station at the Orroral Valley Space Tracking Facility for the purpose of contacting W5LFL on the STS-9 mission. ▶

Will your child grow up to be Chairman of the Board?

Aristotle said 'give me your child from one to seven and I will give you the man.' Put simply he was saying people are products of their environment. Research confirms children brought up in an atmosphere of creativity and learning where they are encouraged to compete are the ones who get to the top.

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Shuttle-to-Houston via amateur radio

Space tracking operations within Australia are supervised by the Department of Science and Technology, who were approached for permission to establish the amateur station. The Department declined permission on the grounds of possible interference to normal Space Shuttle communications. When the Department's decision was learned, they were requested to reconsider.

Because the amateur operations on the Space Shuttle were approved by NASA the NASA representative in Australia, Dr Joe Kerwin, was asked to intercede on behalf of the amateurs. With Dr Kerwin's help, an alternative site was located.

During this pre-mission period, Dr Kerwin was in contact with his ex-Skylab colleague, Owen Garriott, who was flying on the STS-9 mission. When Dr Garriott learned of the interest shown by the amataurs in Australia, he proposed that a special test should be conducted to prove that amateur radio could be used as a viable backup communications link. Dr Kerwin asked the amateur group at Orroral Valley if they would undertake this experiment. This challenge was accepted and the astronauts arranged with the mission planners at Lyndon B. Johnson Space Centre in Houston that one particular orbit would be made available for this historic test. Special frequencies, separate from those used for the normal amateur contacts, were arranged and kept secure by Dr Kerwin until one hour before the experiment took place. Even the orbit to be used was not revealed until after the STS-9 mission had been launched.

Site and setup

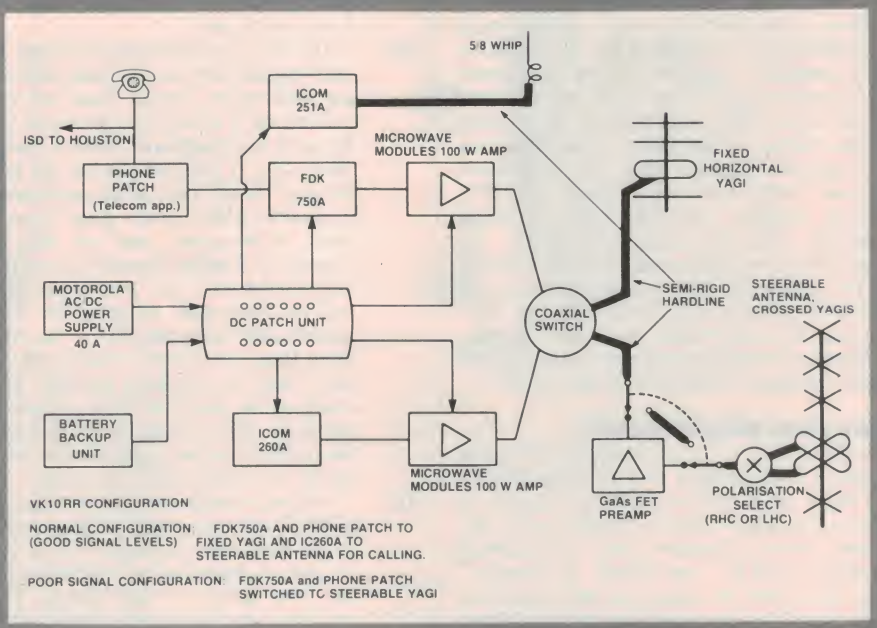
Situated in the Canberra inner-southern suburb of Deaken is the switching and communications centre for all NASA space-tracking voice, data and teletype circuits between Australia and the United States. With Dr Kerwin's help, it was at this centre that the amateur station was established. To this point, much of the ground-work and liaison with Dr Kerwin had been done by Richard Elliott, VK1ZAH, and Paul Bell, VK1BX, whose unflagging optimism and enthusiasm had brought the results so far.

Because of the number of amateurs involved, the special nature of the station, and the participation of NASA through Dr Kerwin, it was decided that a special call-sign should be obtained, if possible. The Department of Communications was contacted and, thanks to their understanding and ready co-operation when the experiment was explained, they issued the special event call sign of VK1ORR for the duration of the STS-9 mission. With the preliminary arrangements completed, the site established and the callsign allocated, the equipment and antenna system was selected.

The choice of antenna was not simple because of the conflicting requirements that had to be met. By this time as well, launch day was approaching and not a great deal of time was available to construct special equipment. As this Shuttle mission had a high inclination orbit (57 degrees to the equator) an omnidirectional antenna would have been desirable. Such an antenna should have a low angle of radiation to ▶

The array of antennas on the roof of the Deakin Switching Centre, Canberra. ▲

Working W5LFL aboard Columbia via VK10RR. Left to right, Darryl Fallow VK1DF, Richard Elliott VK1ZAH and Bob Henson VK1RR. ▲



Block diagram of the VK10RR station setup. ▲

Shuttle-to-Houston via amateur radio

cover the low-elevation horizon portions of the pass, and a higher angle for the maximum elevation point.

These characteristics are, for all practical purposes, mutually exclusive. In addition, physical size and weight had to be kept within manageable limits as the entire assembly had to man-handled onto a roof some 15 metres above ground. The speed of a fast moving spacecraft posed problems for a directional antenna system. Finally, after consideration of all factors, a combination was selected to cover as many possibilities as was reasonable. This combination was a steerable, crossed 10-element yagi with switchable circular polarisation, a 5-element horizontal yagi oriented to maximum elevation of the pass, and a 5/8-wavelength vertical whip. The antennae were mounted on a temporary scaffold erected on the roof of the Deakin Switching Centre. Semi-rigid, low-loss hardline was used to connect the antennae to the equipment. A low noise GaAs FET pre-amplifier was used to improve the receiver noise figure.

The equipment used was provided by local amateurs and was configured in two chains to provide redundancy in the event of a failure. Alternative mains and battery power was available to all essential equipment. Three transceivers were used in the final configuration. These were an ICOM IC260A, an FDK 205 and an ICOM IC251A. The two main chains used Microwave Modules 100 W linear amplifiers with receiver preamplifiers.

This configuration allowed two 100 W uplink paths and the prime receive path threshhold was −140 dBm due to the GaAs FET amplifier. Special delayed transmitter keying was installed to enable the antenna head GaAs FET amplifier to be disconnected before uplink power was applied to the antenna. Thanks must go to Richard Elliott VK1ZAH, Paul Bell VK1BX, Darryl Fallow VK1DF, Bob Henson VK1RR, and Bob Quick VK1ZQR, for their efforts in construction and installation of the equipment. The officers in charge of the Deakin Switching Centre, Mr Des Terrill and Mr John Warth, provided valuable assistance in making space available and for advice during installation of the station.

Houston phone-patch

For the actual contact, and to prove that the amateur system could provide proper backup voice capability to the Space Shuttle, a phone-patch was used to interface with the international telephone system. Dr Owen Garriott W5LFL, on board "Columbia" was then able to speak to the Cap-Com (Spacecraft voice communicator) in Houston via amateur radio through VK1ORR and an international phone-patch.

On Monday evening, 5th December 1983, this historic test took place during orbit 110 of the STS-9 mission. The test proved an outstanding success and demonstrated that amateur radio could provide excellent emergency voice communication.

The orbiter was passing from north-west to south-east over Australia, directly over Melbourne. This pass allowed only six minutes for the contact.

During his conversation with controllers in Houston, Owen Garriott said of VK1ORR: "This is one of the best stations we have heard since we have been in orbit!" A compliment indeed and a tribute to the performance of the VK1ORR station!

Also present for this history-making experiment were the US Ambassador to Australia, Robert Nesen, and Senator Jake Garn of Utah, USA, a member of the NASA Appropriations Committee. The ambassador was able to exchange a few words with W5LFL during the contact which was coordinated by Dr Garriott's colleague, Dr Joe Kerwin.

Contact

Here is a partial transcript of the historic two metre band amateur communications test between W5LFL on board the Space Shuttle "Columbia", and VK1ORR in Canberra. (**S/C** is the Spacecraft "Columbia", W5LFL; **ORR** is VK1ORR and **JK** is the NASA representative, Joe Kerwin).

S/C "Hello victor kilo one oscar roger roger, victor kilo one oscar roger roger; W five lima foxtrot lima, W five lima foxtrot lima".

ORR "W five lima fox lima here is VK one oscar romeo romeo. We copy you five by five. I will now hand you over to Joe Kerwin".

S/C "Columbia coming right back (signal fade) is Joe Kerwin at the station this morning?"

ORR "Roger Owen, we're copying you OK. We have had a problem with the phone-patch. We're trying to get the phone-patch up and then I'll hand you over to Joe".

S/C "OK, that sounds fine and I've got all your signals here on the tape recording and when we get back on the ground we'll be able to acknowledge them all in proper order and er, hullo there Joe, if you can get on the mic all your friends here in the spacecraft wish you hullo as do your friends back in Houston, and we will of course be looking forward to seeing you back home in a few more days and we also want to send our best wishes and many thanks to the fine crew there at Orroral Valley for all their help in tracking for the last week or so and the other previous missions, and an outstanding job has been done and we appreciate it very much. Go ahead now Joe, over".

JK "Alright, sounds like a real science party Owen, it sounds like you're getting a good time up there. I'm ready to turn — Have we got Houston on the line here? — OK Owen, I'm going to turn you over to Houston to complete the contact right now and then I want to get back with you for a minute. Please finish your transmissions with 'over' as we are simplex and I have to push the button for Houston to talk. Go ahead and call Houston, over".

S/C "Hello Houston Cap-Com, Hello Houston Cap-Com, I expect this is er Brian on the line. This is W5LFL, Spacecraft Columbia, go ahead, Brian".

(Houston cap-Com uplink is garble on the tape and unintelligible)

S/C "Roger, outstanding. Load and clear. One of the best stations we've heard ever since we've been in orbit. The attitude of the spacecraft is just perfect, of course. We're looking right,straight down over Melbourne at just about this moment, this very moment, and we just wanted to establish the fact that we could maintain a backup comm. here. John is right behind me and he's been looking forward to er saying hello to you all or having us say hello to you through the backup ham system. — And he's giving us a thumbs up signal right now, Brian, so a fine business; we appreciate the chance to talk with you, go ahead, over".

(Houston Cap-Com transmission is garbled on tape)

S/C "Yeah, John doesn't want to get on the loop here, I would have to change the headset with him Brian, but hello to you also Bill and why don't we go back now to Australia and take a few moments here before we lose contact line-of-sight with Joe Kerwin. Thanks a lot fellas in Houston and back to you Joe, in Australia, over".

JK "OK, thanks very much Owen, I've got the Ambassador, Robert Nesen, here and incidentally, standing behind him is Senator Jake Garn from Utah who says hello to John and he still wants a ride. Here's the ambassador".

S/C "OK, fine Joe, thank you, I just passed along the hello from the senator to John who acknowledges that, and er, I am pleased to have you there also Mr Ambassador so I'm glad to see you all. The Spacecraft attitude really makes the comm. system fine here this morning and we've had a lot of good views of Australia, and er, we want to er as I say a moment ago, wish you all er a lot of many thanks and 73s for all the good work that you've done for us here in the past tracking missions. Go ahead."

(End of partial transcript.)

The performance and success of this experiment was due to the dedication and determination of Dr Owen Garriott W5LFL, Dr Joe Kerwin, and Richard Elliott VK1ZAH, who were able to bypass international and bureaucratic boundaries by their personal involvement and interest. ●

W5LFL VK1ORR

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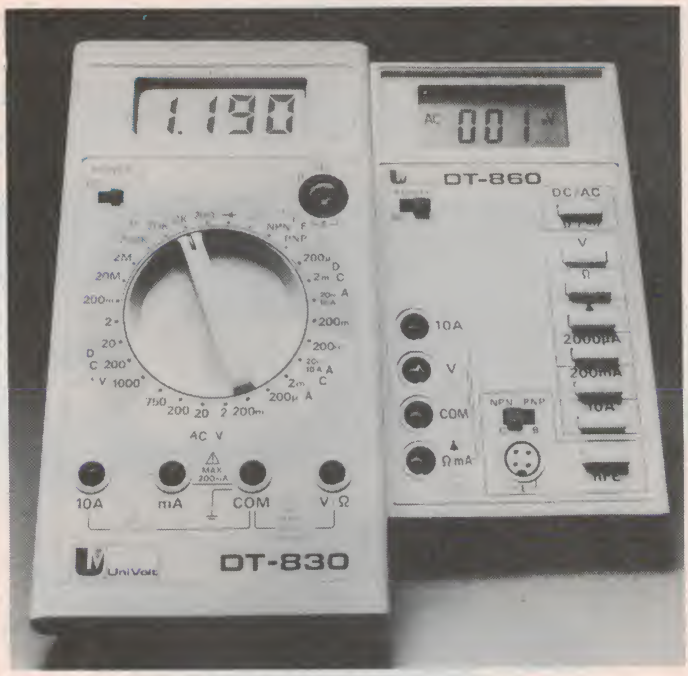

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KODAK ENTERS VIDEO MARKET

Eastman Kodak Company has announced plans to extend its reach in imaging to the worldwide video market. Kodak will market an entirely new 8 mm video camera-recorder system and more than 50 configurations of Kodak and Eastman brand video cassettes and tapes for home entertainment and professional applications.

The products will be manufactured to Kodak specifications in Japan. Video tape will be supplied by TDK and the equipment will be sourced from Matsushita.

"Our new Kodavision series 2000 video system marks the beginning of a new level of convenience in home video recording," noted Mr E. G. Woods, managing director and chief executive officer for Kodak (Australasia).

"The one-piece Kodavision camcorders are highly portable," Mr Woods added. "When compared with current camera and recorder hookups, their advantages become clear. Current ½" two-piece systems usually require the user to shoulder a camera that's wired to a separate recorder unit carried at waist level. The entire outfit may weigh 5 kg or more. But the smaller Kodak 8 mm video cassette (only slightly larger than an audio tape cassette) yields considerable advantages. It makes it possible to design a 2.2 kg cordless model with point-and-shoot convenience."

The new Kodavision series 2000 video system includes two 8 mm video camera-recorders: the Kodavision series 2000 camcorder, model 2200; and the auto focus camcorder, model 2400. The camcorders will accept 8 mm Kodak video cassettes.

The system's visual and audio capability is extremely high says Kodak. Both tapes have the capability of recording digital and/or FM hi-fidelity sound.

The camcorders share several common features. These include a fast f/1.2, 6:2 power zoom lens, a ⅓" Newvicon tube and a fully automatic white balance that adjusts the camera to shifts in colour temperature.

The cameras also feature a fast forward and fast reverse, a 5x visual search, and an electronic viewfinder (actually a miniature black-and-white television screen). A review feature lets the user replay the last four seconds of the most recent recording. Both cameras incorporate an automatic iris for automatic exposure control.

Both camcorders accept cassettes of either MP (metal particle) tape or a higher grade ME (metal evaporated) tape. Both can record for up to 60 minutes on the PAL system, and Kodak anticipates that advances in high density tape technology will result in 8 mm cassettes with even longer playing times.

The Kodavision system's compact playback component, the series 2000 cradle, model 2020, allows users to play back recorded tapes.

The cradle was developed by engineers and designers from Kodak and the manufacturer. It is connected to the user's television. To play a tape, the user inserts the camcorder itself into the cradle. The camera's motor drives the tape. Circuitry within the cradle converts the signals recorded on the tape for television display.

The camcorder's battery is recharged while the camera is in the cradle. The cradle can also recharge a separate battery to extend the time the camcorder can be used.

The cradle is designed to include an optional Kodavision series 2000 tuner/timer, model 2022, a device that allows uers to record television broadcasts. The cradle is designed to be compatible with existing ½" VCRs to facilitate dubbing 8 mm images onto ½" tape and vice versa.

The cable ready tuner/timer has 105-channel capability and offers 12 preset channel positions. It can be programmed to tape up to two programmes over any two-week period.

Kodak video cassettes for the home entertainment market will be sold in ½" width (in both Beta and VHS formats) and in various popular lengths, in regular and extra high grades.

Eastman ½" professional video cassettes are scheduled to be available around mid year in all popular formats and lengths, in high grade and extra high grade quality versions. Eastman ¾" cassettes (in both professional and broadcast quality grades) will be available at the same time. Eastman broadcast quality tape will become available later this year.

For further information contact **Kodak (Australasia) Pty Ltd, PO Box 90, Coburg Vic 3058. (03) 350-1222.**

NEW AKAI VIDEO

Akai has announced a new addition to their video range for 1984, the VS-6EA.

The VS-6EA will join the VS-3EA and the stereo/Dolby VS-8EA in the Akai model range. Like the VS-8EA, the VS-6EA features two-speed recording and playback doubling the recording time of any video cassette. The long play mode gives up to eight hours recording (from a four hour tape). For improved picture quality at normal speed the VS-6EA has four heads, which produce a super-still picture on freeze frame, says Akai.

Akai claims that along with the VS-3EA and VS-8EA the new model has several exclusive features, including the 'can't miss' interactive monitor. The interactive monitor tells you exactly what to do by displaying operating instructions on your own television set. It tells you what buttons to press for unattended recording and even how much recording time you have left on the tape.

The timer allows you to programme the VS-6EA to record up to four programmes over a 28 day period. In case of power failure, there is an inbuilt battery that provides emergency power for up to three days for the tuner memory.

All of the functions of the video recorder can be operated with the 25 function wireless infrared remote control.

The VS-6EA has a front loading tape transport mechanism that enables it to be easily incorporated in an existing home entertainment system.

Other features include fast picture search to find a specific point on the video tape, 8-channel preset tuning and an electronic synthesizer tuning system which ensures that tuning is always accurate and stable, says Akai.

Further information can be obtained from **Akai Australia Pty Ltd, PO Box 309, North Ryde NSW 2113. (02)887-2311.**

SIMPLE-HIGH PERFORMANCE CD PLAYER FROM NAD

NAD's first digital Compact Disc player, the Model 5200, available from NAD retail dealers from January and priced in the mid-$900 range, is a "second generation" CD player that employs newly develped LSI chips for its tracking and digital decoding functions.

Unlike CD players that are festooned with programming controls to provide automatic playback of recorder tracks in any randomly chosen order, the NAD 5200 is essentially a high-performance "manual turntable" for compact discs.

Its unusually simple, logical controls provide rapid access to any track; two-speed cueing in the slow-scan search mode (with audible output to facilitate precise cueing to any point within a track) and the ability to advance or retard the laser's cue point in the music by increments as small as one second.

In view of its operating simplicity and the discs' near-immunity to fingerprints and handling damage, the 5200 is also an ideal record playing system for children.

The laser tracking and digital error-correction circuits in the NAD 5200 are particularly advanced. The standard CIRC (cross interleave) approach to error correction is augmented in the 5200 by a PLL frame-synchronizing circuit that eliminates data losses caused by timing jitter, NAD say.

It also includes a new logic processing circuit that analyzes bit error patterns, doubling the system's capacity for error-correction both before and after signal de-interleaving. As a result, the 5200 securely tracks flawed discs that are unplayable on other, more costly CD players, claim NAD.

Special attention was paid to the design of the analogue output circuitry of the 5200 to ensure that no added noise, distortion or slew-rate limiting would compromise the purity of the playback sound. With its signal/noise ratio of nearly 100 dB, ". . . even the smallest details in the musical texture are heard against a background of velvety silence."

NAD equipment is distributed in Australia by **Falk Electrosound, Rockdale NSW.**

VIDEO/AUDIO ACCESSORIES

GFS Electronic Imports of Mitcham Victoria has just announced the release of two new video/audio-related products from the factory of MFJ Enterprises, Mississippi, USA.

Both units are designed to be used in conjunction with a video recorder and stereo system to provide big theatre quality sound.

First in this new line is the model MFJ-1500 'room expanding audio enhancer'. It makes use of electronic time delay with feedback to simulate the reverberation of reflected sound normally experienced in a theatre.

The room expander connects directly to the audio jack of a VCR or TV. An auxiliary speaker on a stereo system is then connected to its output. Controls provided on the MFJ-1500 are *ambience*, for reverberation, *expand*, for time delay, volume and input.

To complement the MFJ-1500 is the new MFJ-1501 stereo synthesizer. It produdes a simulated stereo from the mono audio output of a TV or VCR.

The MFJ-1501 uses a sophisticated design to create a comb response that puts alternating 1 kHz bands of sound into the left and right channels of your stereo system. This technique is the same used by professional audio engineers to produce simulated stereo LPs for the older mono recordings.

For further details of both the MFJ-1500 room expander and MFJ-1501 stereo synthesizer, contact the Australian distributors, **GFS Electronic Imports, 17 McKeon Road, Mitcham 3132 Vic. (03)873-3777.**

DENON CD PLAYER

Denon engineers found that the digital to analogue conversion process was one crucial area when they looked for ways to improve the CD player. More features and functions were built in and it was made easier to operate. The result is the new DCD-1800.

One of the problems of D/A converters has been the generation of a distortion similar to crossover distortion in amplifiers. To remedy this, Denon developed the Super Linear Converter which they say drastically reduces the distortion and adds sweetness to high frequencies.

Tracking performance is improved too by the new Linear Drive Tracer system which uses a single high-precision pivot shaft instead of the conventional parallel rod system for greater overall stability. Search time is also reduced.

Denon claim a S/N ratio of 96 dB, dynamic range of 95 dB, distortion of 0.003% and wow and flutter so low it can't be measured.

The Australian distributors of Denon equipment in Australia is **Amalgamated Wireless (A/Asia) Ltd, 422 Lane Cove Rd, North Ryde NSW. (02)887-7111.**

SANYO CAR SPEAKERS

Sanyo has announed the release of a new car speaker system — the FSP 401.

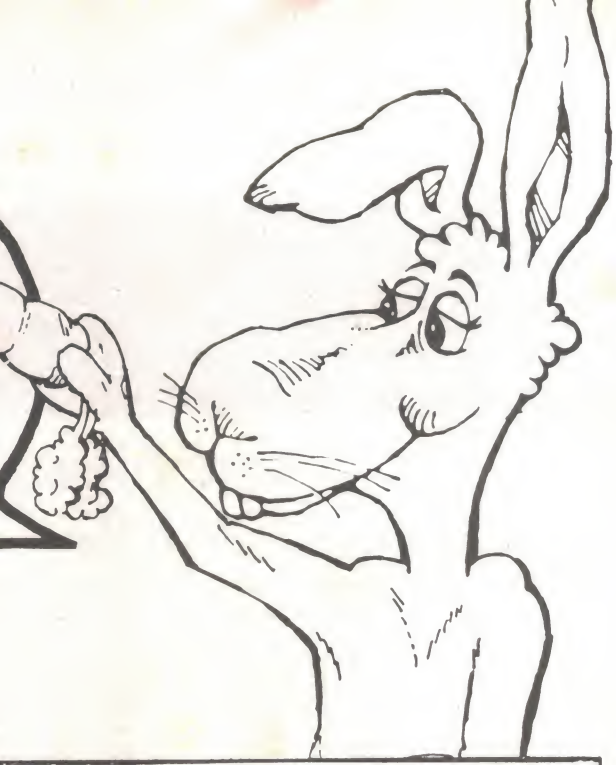
This compact unit is a single cone system with eight watts maximum power handling. It features a frequency response of 70Hz-10kHz and comes complete with a mounting baffle, wiring and instruments.

The FSP-401 is available from car stereo specialists, electrical retailers and department stores for around $15.95.

For further information contact **Mr Wally Fabiszewski, Sanyo Australia Pty Ltd, 14 Mars Rd, Lane Cove NSW 2006. (02)428-0822.** ▶

WE'RE WELL VERSED IN VALUE VIDEO

(SAY THAT QUICKLY!)



DON'T BUY JUST AN ENHANCER!

The DICK SMITH

Video Processor

Far more than JUST an enhancer! This incredible processor enhances, stabilizes, amplifies and modulates as well...Latest imported design is a boon when dubbing, restoring detail normally lost in the process. But it also includes a stabiliser for tapes with 'Copyguard' eliminating the often associated annoying rolling.

Plus it has a video distribution amplifier so you can feed up to 3 other recorders or monitors AND its in-built modulator allows you to watch the enhanced picture during playback on any ordinary TV (great for A/B comparison). Incredible ? Wait until you try it: it's even better!

Cat Y-8510

WHAT A BUY!

$129.95

Fantastic stereo sound from your mono video with this kit!

Stereo Simulator Mk II

Wish those old video movies had modern stereo sound? This low-cost gadget turns almost any mono signal into amazingly good synthetic stereo!

SEE EA APRIL 1983

Cat K-3421

$19.95

EASY TO BUILD COMPLETE WITH INSTRUCTIONS

It's got everything!

Video to Video Cable

Having trouble with video leads? No more! This incredible video lead pack will match ANY video to ANY video with its unique plug & socket system. Cat W-1287

$19.95

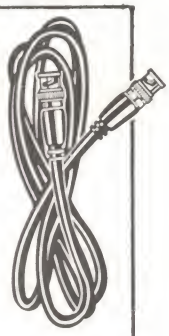
Top quality, top name 3 hour Video Cassettes

Huge bulk purchase of famous name video tapes allow this ridiculous price. Not those imported 'cheapies' which can do a lot of damage to your heads - these tapes are top quality!

VHS Polaroid Cat C-3410
BETA Agfa Cat C-3415

$12.50 ea

BNC to BNC Cable



2 metres quality 75 ohm coax fitted with BNC plugs at each end. Suits many of the VCR's available. Why make one and risk shorts when it's already done for you? Cat W-1285

$6.95

5 up... $5.95

DICK SMITH Electronics

See page 93 for full address details.

ME15 preamplifier and ME75 power amplifier

These Australian designed and manufactured amplifiers . . .
"are very much like the best of the valve amplifiers which I, and many other audiophiles, grew to admire and accept" . . .

Louis Challis

I WAS PLEASED when it was suggested that we review this equipment designed by ME Sound Pty Ltd because we don't often see Australian manufactured or designed equipment.

Contrary to the nasty rumours circulating in Canberra, Australian enterprise is still alive, and ME Sound is probably typical of that enterprise. The firm is young, virile, a trifle avant-garde, and knows about electronic technology.

Perhaps you may not have heard of ME Sound, or their predecessors, Modular Electronics. I must admit that, prior to conducting this review, neither had I. Their equipment is handled by only a very small number of retailers so unless you visited one of the retailers, or happen to know somebody who bought some of their equipment, your chances of seeing or hearing it would not be very great.

The trade literature which arrived with the amplifier and preamplifier was a trifle scanty. Surprisingly, there was no proper handbook or circuit diagram with the equipment. However, the manufacturers did include a price list which will probably frighten all but the most intrepid audiophile into believing that this equipment is beyond his or her budget.

Each of the pieces of equipment came in its own solidly constructed pineboard packing case which the transport company had managed to cover with a brown treacle-like substance. Fortunately, the packing was good enough to ensure that the substance did not penetrate through to the equipment.

The appearance of the equipment did not provide the awe inspiring glitter and panache of the Marantz Esotec range or the functional and very practical characteristics of the New Zealand Perreaux range, both of which we have recently reviewed. ME Sound has chosen the stark and businesslike black colour to clothe their equipment which probably also helps with the thermal dissipation.

While ME Sound believes that 'black is beautiful' the appearance of the equipment is not in any way avant-garde, even though it looks different.

ME 15 features

The preamplifier, in keeping with the Perreaux approach, does not incorporate tone controls and I must state that, in general terms, I support the stance of both ME Sound and Perreaux in this particular matter. The preamplifier's front panel, which is designed for rack mounting, has so few controls on it that you could well be forgiven for wondering why the designer has bothered to put the preamplifier into a separate package.

The controls consist of a power on/off switch, with its associated bezel light, a phono/auxiliary switch and a tape monitor switch, all located on the left-hand side of the panel. A balance control and a gain control are located at the right-hand side of the panel.

The preamplifier's back panel has a pair ▶

of gold-plated phono input sockets, a pair of sockets for auxiliary inputs, two pairs of sockets for tape input and output and a pair of sockets for the main signal output. The designers have also provided a universal terminal which supplies a 15 V signal to the main amplifier, as well as a DIN socket through which a separate power pack provides the main supply voltages for the preamplifier.

The concept of externally powering a preamplifier is not completely new as it does provide the designers with a possible means of reducing magnetic induction from the power transformer. In theory, this may make it possible to reduce hum and noise to a much lower level but this is, regrettably, achieved at a substantially higher manufacturing cost.

While it is possible that the mains hum leakage component in the voltage supplies may be effectively reduced by this approach, I have measured a sufficient number of competing units from other manufacturers to know that this particular approach is not the only way to achieve that aim.

The 15 V supply terminal on the back of the preamplifier provides a signal which switches the main amplifier from standby to a fully operational condition when the preamplifier is switched on. The power amplifier is claimed to operate in the Class 'AB' mode so it is obviously essential to reduce unnecessary power dissipation and consequently this feature must be included.

The inside of the preamplifier is not quite what I expected as it contains six printed circuit boards, four of which are major and two are minor. The minor ones are associated with the gain and balance controls at the front of the unit and also with the separate large and fancy-looking printed circuit board with large earthing strip for the interconnection of the coaxial connections on the rear panel.

ME 15 PREAMPLIFIER AND ME 75 POWER AMPLIFIER

ME 15	
Dimensions:	*435 mm wide x 56 mm high x 300 mm deep.*
Weight:	*7 kg*
Price:	*$695*
ME 75	
Dimensions:	*435 mm wide x 120 mm high x 370 mm deep.*
Weight:	*22 kg*
Price:	*$1295*

Manufacturer and Distributor: ME Sound Pty Ltd, c/- Post Office, Dyers Crossing NSW 2429. (065)50-2254.

The major printed circuit boards are for the twin balanced power supply, the high current output module and the moving magnet/phono preamplifier, together with its plug-in precision RIAA equalisation circuit. Each of these only occupy a small proportion of the available space inside the cabinet. The sixth printed circuit module is associated with the switching controls for power, phono/auxiliary and tape monitor circuits.

The unit is well made and neatly laid out, however, its cost seems a trifle higher than we would expect in terms of either the circuitry provided or based on the competitive prices from other suppliers.

ME 75 features

The main amplifier's appearance is, if anything, more avant-garde than that of the preamplifier. The designer has chosen to place the two large heat sinks on the front panel, instead of the sides or back as other designers do.

These heat sinks flank a pair of operating mode indication lights located at the centre of the panel. A red bezel light indicates that the amplifier is in the 'standby mode' while a green one shows that the amplifier is 'on' and operating normally.

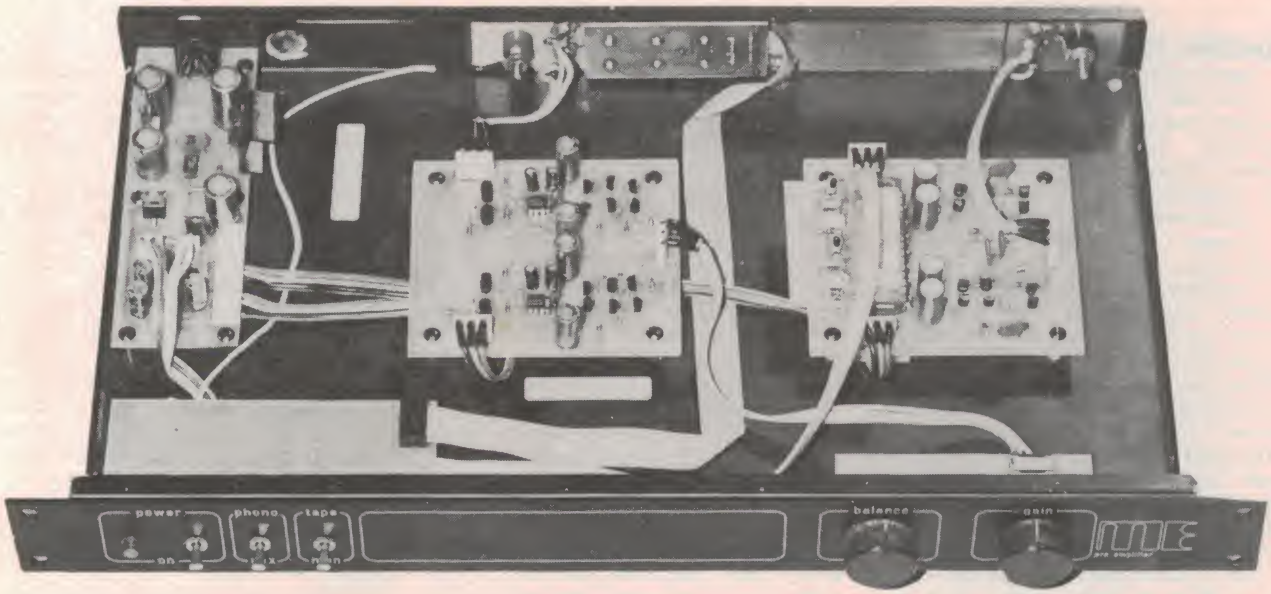
Each of the heat sinks has twelve, 50 mm deep cooling fins extending across the full height of the panel. The external corners of the heat sinks are particularly sharp and, like the external corners of the front panel, are likely to leave a nasty scratch or cut if you happen to inadvertently come into contact with them.

I have criticised Jands for this fault, but they have learnt from their mistakes and their latest amplifiers no longer have this problem.

The back panel incorporates a line input socket on each side adjacent to two pairs of large, colour-coded universal output sockets. The panel also incorporates a yellow universal terminal for the amplifier's power activation circuit.

The only visible protection is a 2.5 A slow-blow line fuse which appears to provide the last line of defence for the amplifier protection.

Unlike the majority of amplifiers on the market, this unit features a Class 'AB' power output stage. This is one way to improve the linearity of the amplifier but only at the expense of considerable power dissipation.



The result is lower power output and the need for a good cooling performance.

This is supplemented by a very unusual drive circuit in which the designers have chosen an even more unusual approach to negative feedback (See Figure 1). The stated purpose for this particular choice of circuitry is to reduce dynamic distortion.

As the figure shows they have divided the circuitry into two sections. The front section is the buffer amplifier in which sufficient feedback is provided to set the correct gain and overall sensitivity.

The second section incorporates the driver and output stages and these use the normal feedback of the emitter follower configuration. This has apparently been done to isolate the speaker from the internal feedback stages, particularly the capacitor and inductors normally required for the feedback loop.

These concepts are apparently based on a design feature proposed by Matti Otala who is renowed for a number of equally topical theories, many of which are currently the subject of heated debate in technical circles. Not surprisingly, some of the most heated debates on these theories have taken place in Australia where the members of the IREE audio group and the associated members of the Standards Association Committee TE/24 have strongly objected to the glaring inconsistencies in Otala's theories as well as some of his claims.

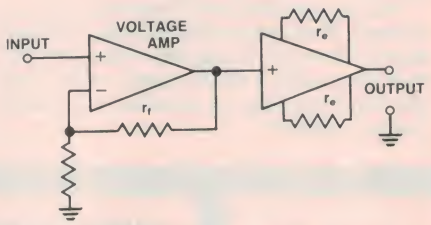


Figure 1. The ME power amplifier uses local compound emitter degeneration with only the front voltage amplifier operating with loop feedback.

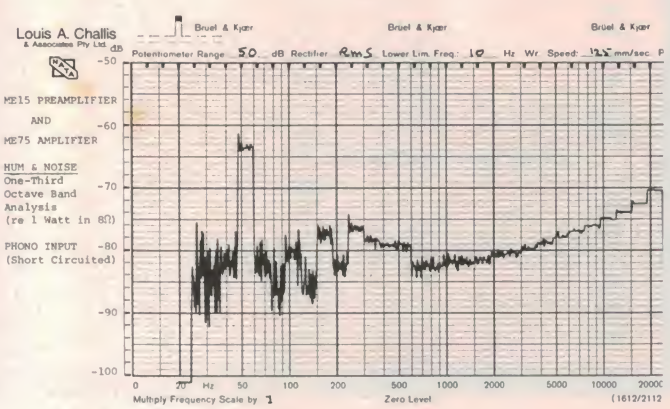
At a recent meeting of the Sydney branch of the Audio group of the IREE Professor Cherry provided a series of demonstrations which personally convinced me that some of Matti Otala's theories and many other generally held theories are quite specious.

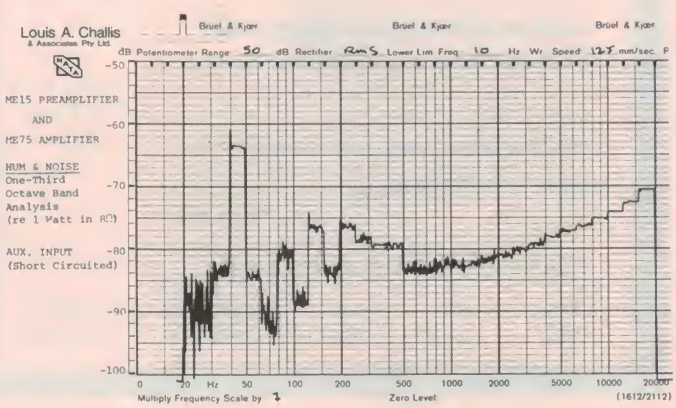
The top panel of the amplifier is well ventilated and when the amplifier is operating (in the class 'AB' mode) the heat generated is enough to make you wonder whether a cooling fan might not have been a worthwhile addition.

The amplifier's internal construction was very different to any other amplifier that I have seen. The first major difference which catches your eye is the array of small electrolytic capacitors mounted on two printed circuit boards with their power rectifiers on each side of the large centrally mounted mains power transformer. The designers claim that this configuration achieves much lower impedances and much more stable rectification than the more conventional single large computer type capacitor which other designers have favoured.

The power amplifier circuit boards are located immediately behind the front external heat sinks and use a novel, but very practical, combination of heat sinks which double as mechanical bracketing. Each of the printed circuit boards uses a pair of side rails onto which the driver transistors are mounted and which enhance the rigidity of the boards and their resistance to external vibration.

The earth wires and signal wires have been designed using very large conductors which ensure minimum impedance over the operating frequency range. The amplifier appears to incorporate an output stage protection circuit although no details are provided as to how it works. ▶





Objective testing

The claims made in the information supplied with the preamplifier and amplifier are quite exciting. All of the significant measurable and audible parameters including frequency response, total harmonic distortion, slew rate, output impedance, signal-to-noise ratio, audible quality, base response, sound definition as well as overall clarity are claimed to be substantially superior when compared to other amplifiers. Most of the other amplifiers, however, are generally less expensive than this particular unit.

The measured performance of the amplifier was not quite as exciting as I would have expected. The frequency response is exceptionally good extending from below 1 Hz to beyond 100 kHz with no sign of low frequency drooping response. This sounds good on paper, but if you happen to drop your cartridge on the platter the chances are that your speaker diaphragm and its voice coil are likely to jump right out of the speaker basket.

A better approach is to offer the user a variable low frequency cut-off setting which provides the ability to remove the low frequency wow and eccentricity information content on the records, as well as protecting the speaker from unwanted excursions.

At the one watt level with the preamplifier and amplifier both operating, the distortion at the three test frequencies of 100 Hz, 1 kHz and 6.3 kHz is moderately low in the range between 0.023% and 0.026%. At the 78 W level the distortion rises to between 0.06% and 0.13%.

However, before you get carried away and start pounding the table or phoning me to complain about the 'high' level of the distortion, I should point out that this level of performance is still reasonably good when you consider that the amplifier does not incorporate a feedback loop connecting the output stage directly back to the input.

The design has been conceived to specifically avoid that requirement, in the interest of achieving a stated set of audible goals. By the same token, these figures are in no way comparable with the better or best amplifiers that we have reviewed in the last few years whose distortion figures, under similar operating conditions, have been as much as three orders of magnitude better than the figures displayed by this system.

As the manufacturer's literature gives a warning about using suitable mains connections we tested the amplifier twice, the second time using a mains supply which does not come through our normal core balance circuit breakers.

We found it interesting that this produced no substantial reduction in the measured level of harmonic distortion; we were convinced that the characteristics of the amplifier are not significantly affected by the choice of mains circuitry.

Obviously, if the amplifier is to achieve the sort of performance that the designers are seeking then the measured 'IEC high frequency total difference frequency distortion' performance should be comparable with the best amplifiers that we have tested.

Surprisingly, this is not the case and the measured performance is not as good as we might have expected. The lowest level of total difference distortion was only 0.08% which is more than 10 times higher than that produced by other amplifiers that we have recently tested.

An equally significant set of parameters is the signal-to-noise ratio. The measured performance for both the auxiliary inputs and the phono inputs only achieves a 60.5 dB signal-to-noise ratio and 67 dB A-weighted performance relative to the one watt level.

An examination of the one-third octave band spectrum reveals a very high level of 50 Hz signal; this is hard to justify after all the trouble the designer has taken with external power transformers for the preamplifier and with the fancy power supply ▶

AMPLIFIER DATA SHEET

MEASURED PERFORMANCE OF ME 15 PREAMPLIFIER NO. 105011X AND ME 75 POWER AMPLIFIER NO. 750001X

FREQUENCY RESPONSE: (-3 dB re 1 watt @ 1 kHz)

No Tone Controls Fitted 1.0 Hz to 100 kHz

SENSITIVITY: (for 1 watt in 8 ohms)

	Left		Right	
AUX	6.4	mV	6.4	mV
TAPE	6.4	mV	6.4	mV
PHONO	140	uV	140	uV
OVERLOAD PHONO	210	mv	210	mv

INPUT IMPEDANCE: (@ 1 kHz)

	Left	Right
AUX	68 k ohm	68 k ohm
TAPE	68 k ohm	68 k ohm
PHONO	47 k ohm	47 k ohm

MAXIMUM OUTPUT POWER AT CLIPPING POINT

(IHF-A-202 (20mS burst repeated at 500mS intervals)

84 V p-p = 110 Watts

Therefore Dynamic Headroom (re 78 watts) = 1.5 dB

OUTPUT IMPEDANCE (@ 1 kHz)

405 milliohms

HUM AND NOISE LEVELS (re 1 watt in 8 ohms)

INPUT	0.5V	AUX.	60.5 dB (Lin.)	67.0 dB(A)
INPUT	5.0mV	PHONO m/m	60.0 dB (Lin)	66.5 dB(A)

HARMONIC DISTORTION:

(A) (At power of 1 watt into 8 ohms)

	100Hz	1kHz	6.3kHz	
2nd	-79.4	-77.4	-76.3	dB
3rd	-72.4	-74.4	-74.2	dB
4th	-91.4	-	-	dB
5th	-91.4	-	-	dB
THD.	0.026	0.023	0.025	%
=dB	-71.7	-72.6	-72.1	dB

(B) (At rated power of 78 watts into 8 ohms = 25 volts)

	100Hz	1kHz	6.3kHz	
2nd	-66.3	-69.1	-68.0	dB
3rd	-59.6	-72.4	-62.0	dB
4th	-73.2	-75.1	-75.7	dB
5th	-65.3	-68.4	-	dB
THD.	0.13	0.06	0.09	%
=dB	-57.8	-64.5	-60.9	dB

(B) Direct to ME75 Amplifier (78 watts)
(Signal generator not earthed) Right Channel

	1kHz	
2nd	-72.4	dB
3rd	-62.5	dB
4th	-75.1	dB
5th	-68.2	dB
THD.	0.09	%
=dB	-61.0	dB

As above supply from Alternative Plug

	1kHz	
2nd	-72.4	dB
3rd	-58.5	dB
4th	-75.1	dB
5th	-64.6	dB
THD.	0.14	%
=dB	-57.3	dB

DISTURB THE PEACE.

We're not suggesting you actually break the law, but aren't you a bit sick of the wimpy sound of most of today's car stereos? You shouldn't need a power booster to let everyone know what great musical taste you have.

Introducing Pioneer's new top of the range in-dash AM/FM Radio/Cassette, the KEH 9000, with peak power of a brain rattling 20 watts per channel.

With locking fast forward and rewind. With auto reverse and automatic 'Tape Slack Canceller' to keep things rolling smoothly, preventing tape 'chew and spew' and protecting your valuable tape collection. With quartz 'Phase Lock Looped' synthesiser tuning for perfect FM reception; no more signal drift. With 15 station pre-sets and night-illuminated controls, including a digital frequency display - all in a logical layout that's as functional as it is beautiful.

The KEH 9000 has a built-in 5-band graphic and a 'Key-Off Pinchroller' to eliminate tape damage. Plus Dolby®, metal capability and much, much more.

And it's only one of 5 sophisticated, totally new systems from Pioneer.

The KEH 9000 is as crystal clear as it is powerful.
But it's only as legal as you want it to be.

PIONEER
Leads the world in Sound and Vision.

Dolby® is a trademark of Dolby Laboratories.

PIC0053

ME Sound Pty Ltd design philosophy

Peter Stein, Managing Director, ME Sound Pty Ltd

This information, supplied to us at our request, is a precis of Peter Stein's handwritten notes.

High current output. For the ME 75 power amplifier to effortlessly drive any commercially designed loudspeaker system it must be able to deliver sufficient current to the loudspeaker when load conditions demand it. The ME 75 is capable of delivering 40 amps, measured at 20% duty cycle pulse, into an appropriate high power load.

Power supply. To supply the amplifier modules with the necessary power an unusual array of low inductance capacitors are connected in parallel. The power transformer is designed to supply large instantaneous power levels in excess of that available at the average power outlet. The losses within the transformer are of the same order of magnitude as the IR losses in the normal household wiring system.

The supplies are independent and no crosstalk is possible, other than by modulation of the mains voltage due to excessive power demands and this only manifests itself at 100 Hz with no effect on imaging since directional information occurs above 200 Hz.

High temperature performance. Dynamic performance is the prime criteria by which the design of ME products has evolved, rather than steady state or static performance. A significant contributor in the area of ME amplifier dynamics is the near constant operating temperature of the output devices.

When a bipolar transistor becomes hot its gain, bandwidth and transient distortion improve markedly, hence the ME 75 has a large constant current heating the output devices to a temperature of 70°C. This current also ensures a low distortion at low levels since the amplifier effectively operates in a Class 'A' mode.

Thermal cycling and its related distortion products are avoided since the transistor junction is already hot, rather than being heated from cold as happens when transistors are intentionally kept as cool as possible.

ME Sound has often looked at MOSFETs as possible output devices but they have two serious problems; their distortion products are then ten times that of a bipolar device, hence ten times the negative feedback is necessary to equal bipolar amplifier designs, and they have a negative temperature coefficient. As MOSFETs heat up the gain decreases and the dynamic range is compressed.

Symmetrical balanced top. ME amplifiers are designed to clip gracefully with a rounded waveform (low order harmonics at the corners), ensuring an inoffensive excursion into overdrive.

It is also important to have a design which does not 'latch up' and here we have utilised a symmetrical topology with equal positive and negative slew rates and settling times. This has another benefit of maintaining very low distortion products by cancelling distortion generated by a 'mirror' effect within the circuitry.

The devices used in the circuitry are hand selected to vanishingly close tolerances; 1% metal film resistors, 0.05% wire wound power resistors, matched sets of semiconductors and hand selected capacitors.

Servo system. In keeping with our philosophy of simple signal processing, a separate servo system monitors and maintains the dc output level at 0±0.001 volts max. rather than overcomplicating the circuit design trying to maintain dc stability.

Remote sensing protection system. This monitors the output of the amplifier and operates once a signal is detected which is likely to damage your loudspeaker.

This style of protection offers a significant advantage as there are no series fuses or relay contacts to detract or interfere with the signal between the circuitry and the loudspeakers. This is the usual practice and these effects increase with age.

The turn-on and turn-off surges which appear at the loudspeaker terminals are inaudible, being less than 0.05 V peak.

A significant fact is that the muting relay used in conventional power amplifiers cannot protect against loudspeaker damage. This is due to a common amplifier failure mode, dc at the output terminals, which invariably equals the full internal dc supply voltage (in a 100 W amp 50 Vdc). This causes the relay contacs to weld together, then vapourises the voice coil of the bass driver.

Therefore, the ME protection network removes the ac mains power from the amplifier, making it more reliable.

No negative feedback. The ME amplifiers do not use a negative feedback loop for the output, driver and predriver transistors, instead, compound emitter degeneration is used with only the front voltage amplifier operating with loop feedback, however, this stage drives the purely resistive power amplifier section.

The system avoids the possibility of loudspeaker effects entering the feedback loop and regenerating throughout the amplifier chain causing 'interface intermodulation distortion', a term used by Matti Otala. The back EMF generated by all dynamic loads can re-enter a conventional amplifier but is isolated by the separate current amplifier embodied in ME amplifiers.

Another advantage of this design is the absence of an output inductor; instability is not a problem and so the circuit can be hard-wired to the loudspeaker, a real benefit when you are talking about esoteric speaker cables of extremely low losses.

Servicing and updating. The modules are easily unplugged and exchanged. This allows the units to be serviced in remote locations while maintaining factory tolerances, as whenever a failure occurs a matched set of factory manufactured modules are fitted.

It also makes it easy to upgrade the old modules to new modules. This system is more economical as you don't have to buy a whole new amplifier.

Updating your hi-fi system? Start with the weakest link.

If your hi-fi system has a weak link, it is most probably the loudspeakers.

If you are about to spend between $400 and $1500 on a new pair of speakers, you will make a costly mistake if you don't first audition the JAMO Professional range before you buy.

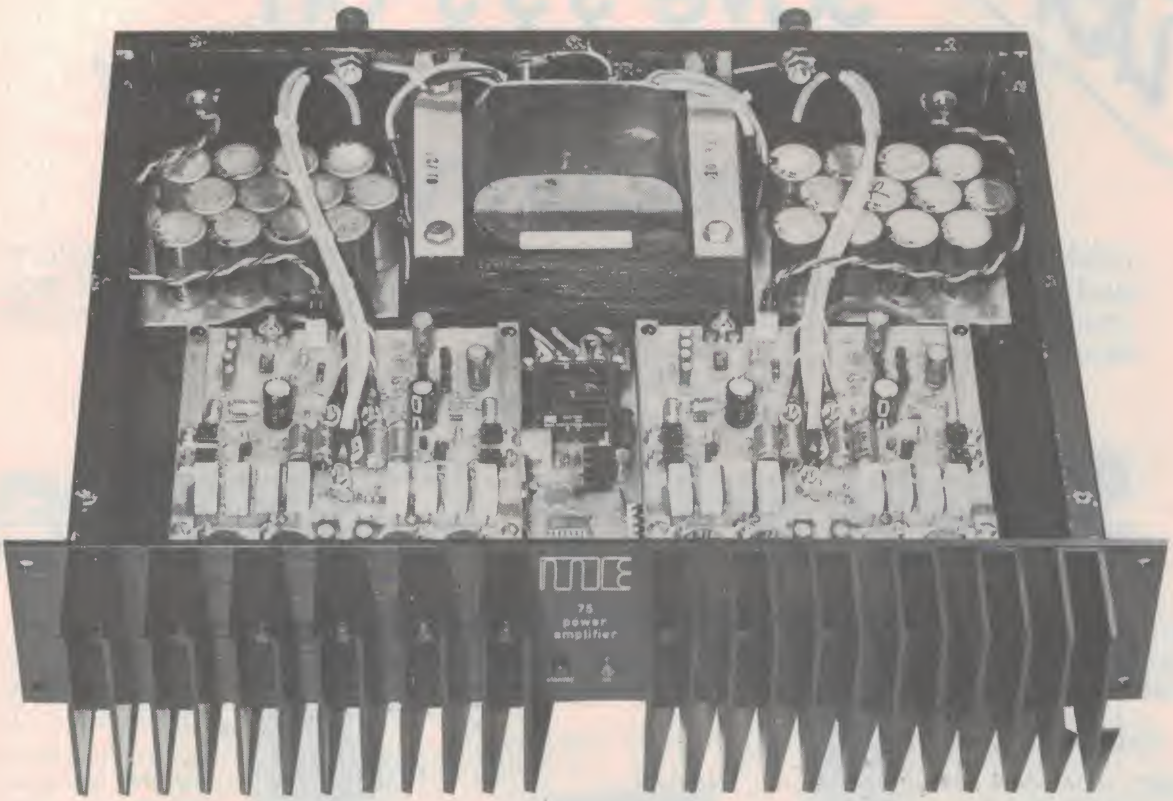
JAMO is a specialized loudspeaker designer. Their new thinking and unique way to solve problems is obvious. Hi-fi critics worldwide have reviewed and acclaimed the speakers. JAMO incorporate the patented **CBR**-system (**Centre Bass Reflex**). It eliminates cabinet resonances found in most traditional speakers. It gives you a tight and uncoloured bass response.

With JAMO Professional you will also get excellent sensitivity, unsurpassed stereo image and phase linearity. You will get fully electronic overload protection and acoustic attenuators. And a speaker which is well suited to digital audio. But you won't get empty pockets . . .

If you give us a ring or send us a letter with your name and address, we will send you our new '84 catalog, a pricelist, a couple of reviews and the name of your nearest JAMO dealer.

Scan Audio Pty. Ltd., Phone: (03) 819 5352
P.O. Box 242, Hawthorn, Vic. 3122

JAMO HI-FI



which incorporates so many capacitors at the back of the amplifier.

The preamplifier sensitivites are, however, relatively good with a 14 μV phono sensitivity and a 210 mV signal required to cause preamplifier overload.

The measurements of maximum output power using the IHF-A-202 test reveals a 110 W peak output into 8 ohms with 1.5 dB headroom. These figures do not match the claims made for the amplifier of 120 W output into 8 ohms. Neither does the peak current match the claimed 40 A peak current capability for single transient peaks.

The test of overload resistance based on our standard overload recovery performance was particularly stable and the unit exhibited no trace of jitter.

The output impedance is relatively high at 405 milliohms but the unit does not appear to exhibit any significant operational vices.

Subjective testing

The subjective assessment of the unit revealed characteristics that are a little different from what I would have expected. The audible characteristics are very much like the best of the valve amplifiers which I, and many other audiophiles, grew to admire and accept as offering better performance than the first transistorised amplifiers which sounded relatively harsh in comparison.

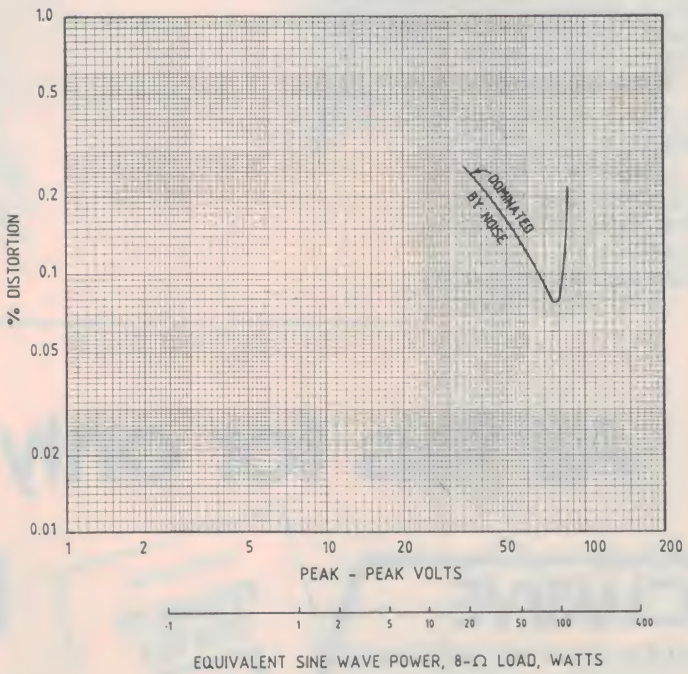
The quality of the sound is unquestionably different to other high quality amplifiers available at the moment. I found this amplifier particularly pleasant to listen to as it exhibits characteristics which are audibly different, particularly on transient material.

When playing classical music and pop the amplifier works very well, but with recommended retail prices of $695 for the preamplifier and $1295 for the amplifier I can't see too many people beating a path to the retailers' door.

Australian enterprise may not be dead but only rich Australians will ever get to hear this particular equipment. ●

IEC HIGH FREQUENCY TOTAL DIFFERENCE FREQUENCY DISTORTION

ME 75 POWER AMPLIFIER



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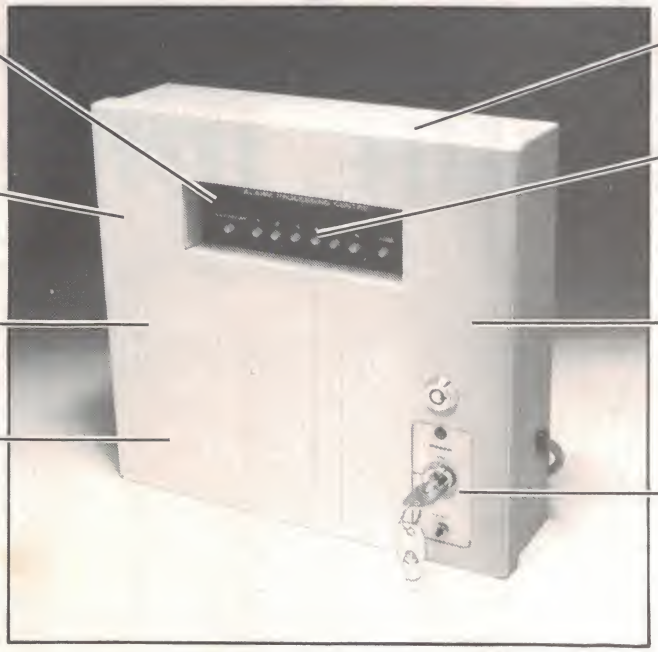

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Cat L-5100

All this for only $199

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See Page 93 for full address details

A711/RW

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	162 Pacific Hwy	GORE HILL	439 5311
	315 Mann St	GOSFORD	25 0235
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	Elizabeth Dr & Bathurst St	LIVERPOOL	600 9888
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	Lane Cove & Waterloo Rds	NORTH RYDE	88 3855
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	263 Keira St	WOLLONGONG	28 3800
ACT	96 Gladstone St	FYSHWICK	80 4944
VIC	Creswick Rd & Webster St	BALLARAT	31 5433
	Cnr Hawthorn Rd & Nepean Hwy	BRIGHTON	592 2677
	260 Sydney Rd	COBURG	383 4455
	Nepean Hwy & Ross Smith Ave	FRANKSTON	783 9144
	205 Melbourne Rd	GEELONG	78 6766
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	Bowen & Ruthven Sts	TOOWOOMBA	38 4300
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3" COMPACT FLOPPY GRABS LEAD IN STANDARDS RACE

Chinon Industries of Japan recently joined the ranks of companies supporting the ⊂⁄-standard. This compact 250KB (500KB in flippy mode) storage unit features low power consumption and 5¼" compatible operation. Chinon's CF031 has a 3mS track-to-track access time and uses standard Compact Floppy media. Schools and remote recording applications will benefit from the rigid jacket and dust protection features of Compact Floppy disks.

GENERAL INSTRUMENTS' SPEECH RECOGNITION CHIP SPEAKS FOR ITSELF

Claimed to be the only real-time linear-predictive-coding-analysis chip on the market, this chip, when teamed with a micro-processor, manages both recognition and synthesis with just one reconfigurable filter. Known as the SP1000, the combo chip will work with most micro-processors and will also work with no hardware interface with the 6502 device.

WESTERN DIGITAL CORP. RIDES THE IEEE STD 488 BUS

A general purpose interface bus (GPIB) controller performs the interface function between the micro-processor and the GPIB. Western Digital's WD9914 is a second source for TI's TMS9914A. The chip automatically handles talker, listener and controller operational modes, relieving the micro-processor from bus protocol maintenance. The WD9914 features system controller service request, serial/parallel polling device, clear trigger and DMA facilities. Look for this one early 1984.

IBM® PC STYLE KEYBOARDS TO TRUE DIN PROFILE

Advanced Input Devices' packaged and encoded keyboard features ergonomically designed tactile feel keys and comes complete with curly cord. Measuring a mere 30mm in height to the home row of keys, the Ergokey Tm ED-184-243 also incorporates a two position angle adjuster. This keyboard is the vanguard for the Ergokey Tm series and is predicted to cost less than $200 plus tax in small quantities.

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BATTLE FOR DESKTOP REAL ESTATE

The new year saw the beginning of the battle for domination of the desktop — suddenly all the computer manufacturers woke up to the importance of making a machine that any executive would be proud to have on his or her desk. In fact, the companies went further than that; they came out with some wizard little machines calculated to make any executive who doesn't have one look rather warily over the shoulder.

The computers in question all went for compactness combined with power; gone are the days when having a computer on your desk means there's no room to do anything else.

Of the many new releases, five machines stood out as likely to make the grade: the Apple Macintosh; the HP-150 with its touch screen; the Apricot; the Eagle; and the MIC-504 from Multitech.

The Apple Macintosh is possibly Apple's last chance to retain its high position in the marketplace. The Lisa was a revolutionary machine with many useful features, but it was just too expensive for most people, especially in small businesses, to invest in.

While there's no Australian price available for the Macintosh at the time of going to press, its US price is expected to be between $2000 and $3000 which, even when translated into Aussie dollars with a hefty import tax added, works out a lot cheaper than the Lisa.

For this reduction in price, however, you don't lose much power or capability. A Motorola MC68000 processor running at 8 MHz has 64K ROM and 128K RAM, with the memory upgradeable to 512K, and a second microfloppy disk drive may be added.

The Macintosh retains the Lisa's mouse/icon arrangement of operation, which makes it a cinch for even the most ignorant computer novice to work with. For example, when the Macintosh is switched on it displays a floppy disk on the screen as an icon. By clicking the mouse on the icon, the user opens the disk to reveal a window showing more icons for the various files and folders on the disk ('folders' are directories containing other files).

Moving the mouse to one of these folders and clicking twice will open the file and invoke the appropriate applications program to display it — all without the user having to know what is happening in computing terms.

Four applications for the Macintosh will initially be available: MacWrite, a word processor; MacPaint, a drawing program; and MacPlan and MacChart, which are spreadsheet and graphing programs (respectively) from Microsoft.

The Macintosh is an unusual shape for a personal computer, taking up more space vertically than horizontally; ideal for minimising the space needed for it on a desktop.

Hewlett-Packard's HP-150 has two things going for it: its incredibly small size and its touch-sensitive screen. Its 305 mm footprint makes sure it won't dominate the desktop, but the basic unit still manages to contain 256K of memory, two serial I/O ports, an HP-IB inteface, a screen — and room for an optional printer. To add to this machine's appeal, it uses an 8088 processor and the popular MS-DOS operating system.

The 23 cm screen is a very high-quality green phosphor type, with a resolution of 512 by 390 for graphics and 720 by 378 for alphanumeric display. Both can be displayed at the same time, and this is how many of the touch screen graphics work.

The touch-sensitive screen is what it sounds like; the user can make things happen simply by pointing to areas on the screen. 'Touch screen', in fact, is not strictly accurate. HP Touch consists of a grid of infrared light beams just in front of the screen.

The 14 horizontal by 21 vertical beams define a 23 by 40 grid on the text screen and set of eight programmable function keys along the bottom of the screen. When you point to and/or touch the screen you break at least one vertical and one horizontal beam, which returns a code to the system indicating what part of the screen is being pointed to.

How this information is used depends on the software, but it means that areas of the screen can be defined in menu form, and the user need only point to the appropriate area of the screen to make a selection.

VisiCalc and WordStar are available for the HP-150, and such popular packages as Lotus 1-2-3, dBase II, Multiplan and Condor are promised for the near future. All the software runs under HP's 'Personal Applications Manager' (PAM), which forms a user-friendly bridge between the operating system and the user. ▶

The HP-150. "Ta-ta-ta-ta-touch me, I wanna be dirty".

The Apple Macintosh. Man or mouse control?

The Eagle PC Plus is available in configurations with either floppy or hard disks (retailing for $3840 with one floppy drive, $4580 with two, and $7380 with 10M hard disk storage), and is claimed by its distributors, Asia/Pacific Technology marketing Pty Ltd (ATM), to be fully compatible with the IBM-PC and XT.

The Eagle was specifically designed for desktop use, and offers an 'enhanced' IBM keyboard with 84 keys, 10 function keys and a 10-key numeric pad.

Powered by a 16-bit Intel 8088 microprocessor, the Eagle has as standard 128K RAM, expandable to 640K on the main CPU board without adding extra pc boards. The design accommodates both 64K and 256K dynamic RAMs, and all models have four IBM-PC compatible option slots. There are also two serial and one parallel ports for printer, modem or mouse connection.

The Eagle . . . they fly high in Mobile.

The Eagle PC Plus runs under both MS-DOS and CP/M-86, and word processing and spreadsheet software is available for it.

The Apricot, distributed in Australia by Barson Computers, has been announced as a 'Fourth Generation Computer', which the manufacturers, Applied Computer Techniques Ltd of the UK, define as "an almost total shielding of the user from the intricacies of computer operating systems".

The Apricot comes standard with one microfloppy drive, a 23 cm screen monitor and the new 'microscreen' with a liquid crystal display which, with its six associated touch-sensitive keys, provides dynamic choice of operation within each application program, acts as a window on the screen, allowing the system to be used without a monitor if necessary, displays the day, date and time whenever required, and acts as a calculator without necessitating an exit from the main computer system.

A second drive is incorporated in the basic unit, making expansion simple, and the whole package is an extremely compact, elegant desktop design.

The system comes with three operating systems (MS-DOS II, CP/M-86 Plus and Concurrent CP/M-86), a full range of utilities, System Manager, Digital Research's GSX Graphics, asynchronous communications pack, and a printer spooler. It runs three microprocessors: the 8086, the 8089 I/O processor, and optionally the 8087 maths processor. The keyboard can both transmit and receive data.

The Apricot is claimed to run 90% of IBM-PC software with its IBM emulator, and has a recommended retail price of $4444.

The Apricot. Fruitful for Barson?

Multitech's MIC-504, distributed in Australia by Emona, is a single-board, Z80A-based computer with 4K ROM, 64K RAM and 2M of storage provided by two 5.25 inch floppy drives. It has two full-duplex RS232 serial ports with baud rates programmable from 110 baud to 19:2 kilobaud, as well as one Centronics parallel port.

The Z80A processor provides access to the large library of CP/M 2.2 applications programs, but the MIC-504 comes with a fully documented software package comprising Word Right, a word processor; Spell Right, a user-expandable 20 000-word dictionary; Magic Worksheet, a spreadsheet program; Qsort, a sorting utility; Analyst, a database management system; and NAD, a name and address file with Word Right merge facilities.

So there are the contenders for the top position on desktops throughout the world. It'll be interesting to look back in a year's time and see which machines have made it to the top. ●

Multitech MIC504. "No Frills" on the desktop.

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WE HAD SUCH GREAT RESPONSE TO OUR FEBRUARY SPECIALS, THAT WE HAVE EXTENDED THEM TO THE END OF MARCH '84

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(SCOOP PURCHASE FOR OUR KITS)
NORMALLY $19.95

	1-9	10+
THIS MONTH	$14.95	$13.95

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SAVE, SAVE, SAVE,
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DON'T DAMAGE YOUR IC'S WHEN YOU HAVE TO PULL THEM OUT. **1-9** $1.20 **10+** .95

2K OHM MULTIMETER
11 RANGES POCKET SIZE

SPECIFICATIONS
11 RANGES
DC VOLTAGE: 0-10-50-250-1000 volts
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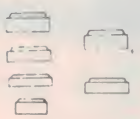

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(UNREAL PRICE. BUT ABSOLUTE TOP QUALITY)

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$7.95	$6.95	$5.95

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WITH PINS FOR EASY BOARD INSERTION

1-9	10-99	100+
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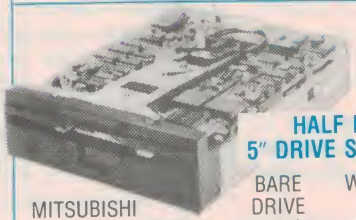
P11012	1680	27.95	**$19.95**
P11015	2420	45.00	**$29.95**



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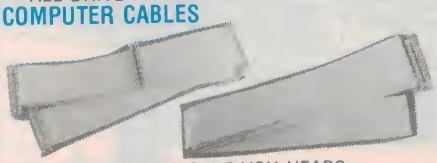

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CHASIS PUNCH SET
(WE KNOCK A HOLE IN THE OPPOSITION'S PRICES ON THIS ONE) **$16.95**

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NORMALLY $2.50 EACH

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THE STING DISK FOR MICROBEE™ 50 only in stock WAS $395.00 NOW $195.00. GET IN QUICK.

5 CP-80 RIBBONS FOR $49.50 (HOW DO WE DO IT?)

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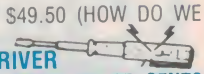
WE HAVE ZAPPED THE PRICE TO 75 CENTS



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EC-80 PRINTER

Energy Control has recently released the EC-80 dot matrix printer available for less than $250 in quantity of 50 units.

The EC-80 is a compact desk top dot matrix impact printer used for hardcopy of data from any microcomputer, personal computer, office computer etc. It will print upper and lower case alpha-numeric characters in both Normal and Italic fonts, in condensed, normal or enlarged sizes and in normal or enhanced modes.

It features both friction and adjustable sprocket feeds as standard; high print quality from carbon film ribbon: logic seeking for faster throughput; high resolution bit-image graphics (640 dots/line); built-in graphics symbols; self-stacking paper basket; square pin print head for improved character registration.

Further information can be obtained from **Energy Control, PO Box 6502, Goonda Qld 4300. (07)288-2455.**

CONTROLLER COMBINES HARD AND FLOPPY CONTROL

A multibus-compatible mass-storage controller that combines control of both Winchester and floppy disks on the same board is being offered by National Semiconductor.

The BLC-8230 and BLC-8232 disk controllers are capable of supporting up to two Winchester and two floppy-disk drives. In particular, the BLC-8230 controls up to two 20 cm Winchesters and two 20 cm floppy-disk drives, while the BLC8232 controls up to 13 cm Winchesters and either 13 cm or 20 cm floppy-disk drives.

Both products represent a single-board solution to the problem of addressing the two most popular types of peripheral memory. The BLC-8232 provides an SA1000-type 20 cm disk interface, and the BLC-8232 a 13 cm ST506-type interface.

Capable of handling 16, 20 or 24-bit addresses, as well as byte or word-size data transfers, the new disk controllers offer a number of key performance features to users.

These include support of either eight- or 16-bit I/O addressing, programmable error retry with media fault management, comprehensive on-board diagnostics, and the ability to perform direct multisector transfers at the full disk data rate.

For more details, contact **National Semiconductor, Cnr Stud Road and Mountain Highway, Bayswater Vic. 3153. (03)729-6333.**

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NEW INTERFACES FOR IBM PC

3D Digital Design and Development has announced the introduction of two interface systems for the IBM PC. These are the Inlab and Thinklab.

Both systems are modular in design allowing a number of extended Eurocard subunits to be slotted into a 19" industrial rack. These modules include multi-channel analogue to digital converters, digital to analogue converters, instrumentaion amplifier, thermocouple conditioning amplifier, intelligent stepper motor controller, programmable shaft encoder etc.

Both interfaces allow up to 128 analogue inputs, 64 analogue outputs, 384 digital input lines, 129 on/off outputs etc. Both analogue inputs and outputs have 12-bit resolution. Digital input and output lines may be opto-isolated from the interface.

Thinklab has been designed specifically for remote data acquisition and control over a serial communication link such as the RS232C or equivalent.

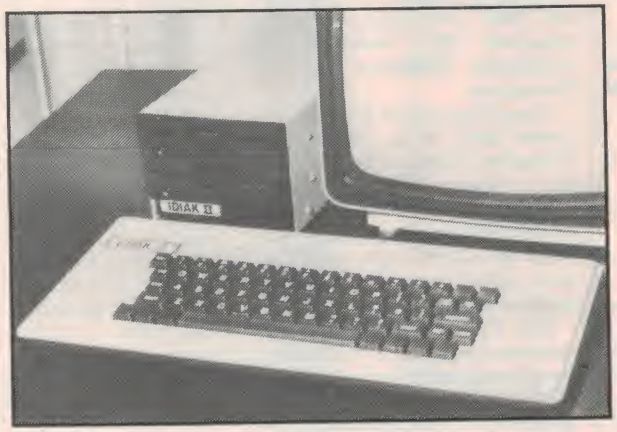
The Inlab Buss controller card may also be used by itself as a 24 line bidirectional input/output device with status bit and interrupt facility.

The company claims that the combination of the IBM PC and 3D interfaces offers a very powerful system with maximum adaptability but without incurring high costs.

3D provides full product support including a detailed manual and suite of demonstration programmes on a diskette. Machine code programming and custom softwear can be written against specification.

For further information please contact **3D Digital Design and Development, 18/19 Warren Street, London W1P 5DB.**

IDIAK II LOW COST QUALITY TERMINAL FAST CP/M 2.2 COMPUTER



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APPLE II MOUSE

Apple Computer has announced a mouse and new software called MousePaint which it will offer early next year for its Apple II personal computers.

A mouse is a pointing device that can be used instead of a keyboard to select computer operations and modify information displayed on the screen. Apple's Lisa computer, introduced earlier this year, ignited broad interest in the mouse among computer owners, software developers and other computer manufacturers. The Lisa is designed to be almost completely controlled by a mouse, one of the things that makes it much easier to use yet more powerful than conventional computers.

AppleMouse II will be packaged with MousePaint software that uses the mouse to design charts, diagrams, free-hand drawings and other visual aids for reports and presentation. Users can insert text in a drawing and can choose from a variety of character fonts and fill patterns. MousePaint simulates bit map graphics to support the Apple II family's high resolution capabilities.

Independent software developers are being encouraged to write applications that take advantage of the mouse. Most future Apple software programs for the Apple II family will offer the mouse as an option.

For further information contact **Apple Computer Australia Pty Ltd, 37 Waterloo Rd, North Ryde NSW 2113. (02)888-5888.**

MACINTOSH — SOFT WEAR SOFTWARE?

Microsoft has announced a full line of application software for the Apple Macintosh and its intent to announce other programs for the Macintosh as well.

Microsoft claim that their versions of Multiplan, Word, Chart and File programs comprise the first line of software to be announced for the Macintosh by any vendor. In addition, Microsoft BASIC is also available for the Macintosh.

The company says that Macintosh's unique interface, together with the Microsoft programs, provides a powerful and functional environment for increasing a user's productivity. The high resolution graphics screen enables graphics to be applied universally to all modes, whether they be charts and graphs as in Microsoft Chart, columns of figures in Multiplan, or words, sentences, and paragraphs in Microsoft Word. Thus, users can readily combine text with graphics without the usual intermixing problems.

Further details of this software can be obtained from **Microsoft Pty Ltd, PO Box 98, Terry Hills NSW 2064. (02)450-2522.**

H-P TOOLS FOR ZILOG

Zilog Corporation and Hewlett-Packard have announced a collaborative effort in which HP will develop support tools for the new Z800 family of microprocessors.

The cooperative project will provide significant benefits for users of Zilog microprocessors and the HP 64000 logic-development system. Such as support tools for the Z800 microprocessor will be available much earlier than otherwise possible.

Otherwise the HP64000 design and development aids will be closely attuned to the Z800 device, allowing designers to take full advantage of the distinctive Z800 CPU features from the very first phases of development.

The Z800 microprocessor family integrates cache memory, a memory-management unit, an interrupt controller, DMA channels and timer/counters with a powerful central processing unit. These features, coupled with a versatile instruction set and up to 25 MHz clock rates, provide a solid base for the development of effective and cost-efficient 8-bit and 16-bit microprocessor-based products. Code written for Z80-based products is transferable to the Z800 CPU without modification, making a transition to the new processor easier.

For further information contact **Z Systems Pty Ltd, 1966 Vulture St, South Brisbane Qld 4101. (07)44-3715.**

MICROPROCESSOR FUNDAMENTALS AND APPLICATIONS

A two-part course of microprocessor fundamentals, with a sequel on microprocessor applications, will be offered by radio and cassette as part of the University of New South Wales continuing education program for 1984. The series is being repeated after being widely acclaimed following previous broadcasts.

According to the lecturer, Dr David Mee, of the University's School of Electrical Engineering and Computer Science, it requires no more than a basic understanding of electronic circuits and simple logic networks, and only general computing experience, to do the courses.

Part 1 of Microprocessor Fundamentals reaches a level where simple programming and application of microprocessors can be understood. Part 2 discusses further hardware and software functions, typical evaluation modules, and demonstrates how to design, develop and debug a simple project on a microprocessor.

The course on Microprocessor Applications will enable the student to use a microprocessor in his own system for measurements, monitoring or control. It covers applications in a variety of common situations, each exemplifying different aspects of microprocessor systems design.

Each part of the microprocessor fundamentals course consists of 10 broadcast lectures, a video program and two attended tutorials at a cost of $42.50. There are 8 radio lectures, backed by a video program and two tutorials on microprocessor applications for $35.

The broadcasts start on 10 April, each lecture being broadcast at 8 pm on Tuesdays and 7 pm on Fridays over the University's educational radio station, Radio University 2UV.

Audio cassettes of the lectures are already available, at $80 for each part of Microprocessor Fundamentals, and $64 for Microprocessor Applications. The video programs cost $30 or $50 each, depending on the format chosen.

Transistor radios adjusted to pick up Radio University courses in the Sydney metropolitan area are available for $12, including postage.

Full particulars on this and other continuing education courses by radio and cassette can be obtained from the University of New South Wales by phoning (02)662-2691.

NEW IMPROVED LOW-COST DIRECT MODEM

Dick Smith Electronics has just released a new version of its Dataphone direct-connect data modem. The new Dick Smith Dataphone II offers not only upgraded performance, but also includes a pushbutton type electronic phone. It sells for the same price as the original model: $199.

Besides the added convenience in establishing data calls, the built-in phone brings a further bonus: installing the Dataphone II is now simply a matter of the user plugging it into a standard Telecom phone socket. There's no delay or installation fee to pay.

The built-in phone also provides a last-number-redial facility, which makes it much easier and faster to re-establish a call following a dropout.

On the performance side, the Dataphone II offers improved demodulator phase stability and significantly greater tolerance of Telecom line impedance variations, claims Dick Smith.

Original Dataphone features still featured in the model II include: full duplex, answer/originate operation for convenience; operates at the standard switched-network data rate of 300 baud; designed and manufactured in Australia and fully authorised by Telecom; uses standard RS232C computer interface and provides 'carrier detect' output and LED indication.

Designated as Cat X-3272, the Dick Smith Dataphone II modem is available from all Dick Smith Electonics stores, plus selected resellers.

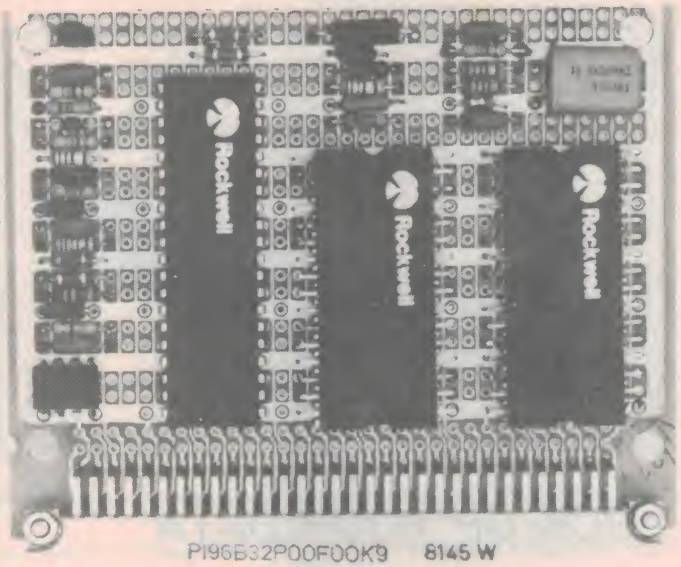
ANOTHER MOUSE

Penny & Giles Potentiometers have released the model M2/100 Mouse.

This device translates movement over any convenient flat surface into movement on a computer screen, thereby eliminating many laborious cursor and keyboard control operations. Three finger operated button switches are fitted as standard. Its primary uses are cursor control, menu selection, graphics and text editing.

Its features include: self cleaning bearing surface; easily dismantled for cleaning after accidental contamination; high impact low friction bearings for main drive ball; operates on a wide variety of surfaces; non contacting solid state pulse generators and low cost.

Penny & Giles are represented in Australia by **Paton Electronics, 90 Victoria Rd, Ashfield NSW. (02)797-9222.**



MODEMS ACT LIKE PERIPHERALS

LSI-based modems from Energy Control designed to link to the microprocessor buss, offer an error rate of 1 in 10^6, claim the company.

The family of highly integrated 1200, 2400 and 9600 baud card-level modems designed to be addressed as microcomputer peripherals is aimed at several lucrative market segments. The models in the line cost $450 in unit quantity for 1200 baud full-duplex units.

The modem family derives from Rockwell-designed very large-scale integrated circuits: two basic signal-processing devices with memory capacities that vary with performance. They might eliminate up to $50 of components previously required to implement modems.

More importantly, these chips boost the modems into full-fledged computer peripherals, with control data transferred over the microcomptuer bus, explains Dennis Kaliher, general manager for telecommunication products.

Rockwell International is represented in Australia by **Energy Control, PO Box 6502, Goodna Qld 4300. (07)288-2455.**

APPLE AND FRANKLIN TERMINATE LITIGATION

Apple Computer and Franklin Computer Corporation have announced that they have agreed to terminate the litigation commenced by Apple against Franklin in the Federal Court in the Eastern District of Pennsylvania by the entry of a judgement of US$2.5 million against Franklin and Franklin's agreement not to infringe on Apple's copyrights.

In its complaint, Apple asserted that Franklin had copied fourteen of Apple's computer operating system programs. Franklin had challenged the validity of Apple's copyrights and also asserted that Apple was guilty of anti-trust violations and unfair competition.

A decision by the third circuit court of appeals held that Apple's operating system could be protected by copyrights. The consent judgement, when entered, will settle Apple's copyright claims in Apple's favour and dismiss Franklin's pertinent counterclaims.

The settlement agreement between Apple and Franklin sets up an arbitration procedure for any future copyright infringement disputes between the companies relating to any substitute Apple-compatible computer program.

LOCK UP YOUR DATA

The JED DataSafe is a new Australian-designed way to hold 64K of data safely and securely in any data gathering, machine monitoring or recipe holding application.

The data is locked away in a box full of lithium battery powered CMOS RAM against marauding power supply dropouts, shock, vibration, humidity, temperature extremes and passing time.

The DataSafe is designed to replace cassette tapes, punched tape or EEPROMs with their high voltage requirements. The DataSafe does away with the need for cassette and floppy drives with their motors, or the complexities and power requirements of bubble memory with its fancy pulses and ramps. It offers an easily loaded and unloaded data store which is then easily transported.

It is a 30 x 60 x 115 mm diecast box and connects via a 15-way D-type connector to a data reading or writing system. During reading and writing, the box draw a few microamps at 5 V. If the DataSafe is then disconnected, or the main system power goes down, the data is stored for years in the RAM.

The DataSafe is available in 8, 16, 32 and 64 kilobyte capacities and a version is also available with two sockets to make the box a safe way to hold and transport 16 kilobytes of PROM data in 2764s. Full details from **JED Microprocessors Pty Ltd, PO Box 30, Boronia Vic 3155. (03) 762-3308.**

8-BIT MICRO WITH 12K ROM

The first 8-bit, single-chip microcomputer with 12K bytes of on-chip ROM has been announced by Texas Instruments.

The new TMS70120 can store a complete, 12K applications program without the need for any external ROMs, buffers and latches. By reducing the chip count for applications in the 4K-12K program range, the TMS70120 allows OEMs to lower the cost, power consumption, weight, and space requirements of many 8-bit applications.

The TMS70120's large, on-chip memory frees up the twenty or more general-purpose I/O lines usually required to interface a microcomputer with off-chip ROMs. This gives designers much greater flexibility to enhance an application by interfacing the TMS70120 to various peripherals.

These capabilities make the TMS70120 well suited for 8-bit applications with moderate memory requirements. Possible uses range from point-of-sale terminals and test equipment to 'smart' appliances and auto dashboard controls.

Fabricated using NMOS technology, the TMS70120 operates from a single 5 V supply. Nominal operating frequency for the device is 5 MHz, with a typical power dissipation of 550 mW. The TMS70120 is provided in a standard 40-pin, 600-mil, dual-in-line plastic package.

For further information, contact **Texas Instruments Australia, SemiConductor Group, 6-10 Talavera Road, North Ryde NSW 2113. (02)887-1122.**

NEW DOS FOR APPLE II

Apple software developers are being supplied with a new disk-operating system for the Apple II family of personal computers.

Distributed by Apple Computer Australia for applications development, the Prodos system provides increased compatability between Apple II and Apple III environments and the higher performance required for more sophisticated Apple II applications.

Prodos uses the hierarchical file structure, file-naming conventions and data formats of the Apple III sophisticated operating system. As a result, Prodos data files and data media are interchangeable on the Apple II or Apple III.

Produs' design frees the Apple II from the physical limitations of the 143K Apple disk II drive. Using Prodos, the Apple II can handle larger files, such as those often required by the word-processing and data-base applications. It can also recognise any storage device, either floppy or hard disk, that uses Apple's protocols.

In addition, Prodos' hierarchical, Unix-like structure provides the Apple II user with an organised method for managing larger numbers of files on larger storage devices.

Prodos does not make the Apple DOS 3.3, SOS or Pascal operating environments obsolete, and all will continue to be available as licensed products from Apple. Users will be able to convert DOS 3.3 data files, so that they work with Prodos-based application programs, to take advantage of the advanced capabilities that Prodos provides.

For further details, contact **Apple Computer Australia, 37 Waterloo Road, North Ryde NSW 2113. (02)888-5888.**

SEVEN-USER NETWORKING SYSTEM FOR THE DESKTOP

The Discovery 500, a desktop networking computer for business, science and industry, has been released in Australia by Archives Computers.

The Discovery 500 is an S-100 desktop single- or multi-user system offering both eight- and 16-bit microprocessors and up to 26 megabytes of inbuilt hard-disk storage.

The basic system is just under $9000.

A feature of the Discovery 500 is the 8086/8087 16-bit processor option and its ability to expand disk storage to 128 megabytes.

With the aid of the 8087 numeric data processor, the Discovery 500 can execute 'number crunching' programs at speeds previously only attainable on mainframes.

The Discovery 500 user has a choice of four operating systems, including CP/M, CP/M 86, CP/M Plus and DPC/OS.

Available with the system is a series of Dataflex-based programs, which enable up to seven users to be able to inquire on or update the same database at the same time.

File- and record-locking is managed by the system so that full database integrity is maintained without noticeable delays in response.

With database files, all data needs to be entered into the system only once, and each user can call on this information under various applications programs.

The Discovery 500 complements the Discovery Multiprocessor 16-user system released late last year.

For more details, contact **Archives Computers, 163 Clarendon Street, South Melbourne Vic. 3205. (03) 699-8377.**

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- Auto repeat enable/disable
- Keyboard lock enable/disable
- Repeat rate 20 characters per second
- 5 cursor control keys, 10 editing function keys with 14-key numeric key-pad

Communication
- Code: 128 ASCII characters
- Baud rate: 75, 110, 150, 300, 600, 1200, 1800, 2400, 4800, 9600, 19,200
- Parity: Odd, even, mark, space
- Operating Mode: Full duplex, half duplex or block mode
- Interface: EIA RS-232C or 20-mA Current Loop

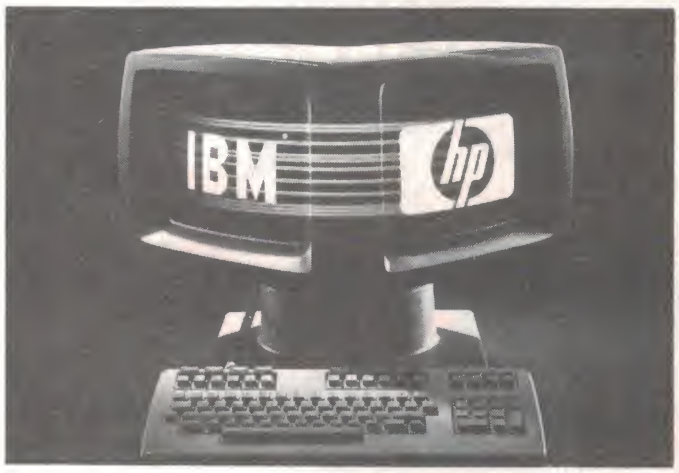
Emulation
- LEAR SIEGLER ADM-3A, HAZELTINE 1500, ADDS VIEWPOINT

Screen Presentation
- Display format: 24 lines x 80 characters
- Display unit: 12-inch, non-glare Green CRT
- Character type: 7 x 9 dot matrix
- Refresh rate: 50/60Hz
- Character set: 96 ASCII characters, 15 graphic symbols, 32 control character symbols
- 5 screen attributes: Blink, underline, blank, reverse, dual intensity
- Cursor type: Selectable slow, fast blinking or steady cursor, block, underline or invisible cursor

Editing Function
- Cursor: up, down, left, right, home
- Insert character, delete character, insert line, delete line, erase to end of line, page and field, field tab, field back tab, column tab, column back tab, block mode on/off, protect mode on/off, graphic mode on/off, clear unprotected.

External Control
- Power on/off
- Contrast adjustment
- Baud rate
- Parity and data format
- End of message
- Emulation mode
- Refresh rate
- Half duplex or full duplex
- Auto line feed
- Auto new line
- EIA or 20-mA Current Loop
- Reverse video or standard video

ENQUIRIES FROM: AVAILABLE FROM OFFICES AND SHOWROOM PARIS RADIO ELECTRONICS, SHOP 1, 165 BUNNERONG ROAD, KINGSFORD, NSW 2032. TEL. (02) 344 9111. TELEX AA22579.



H-P WORKSTATIONS SUIT IBM SYSTEMS?

Two new terminals from Hewlett-Packard Company provide individual workstation capabilities for office-automation applications.

The HP 2625A dual-display terminal can communicate with both H-P and IBM systems simultaneously. On the IBM system, the terminal emulates the IBM 3276/78 display station.

By pressing a single function key, the user selects either the H-P or IBM feature set. Word-processing and graphics capabilities are available as options.

The HP 2628A word-processing workstation operates as a dedicated word processor under control of HP 3000 Word software. Graphics capabilities are available as an option. The HP 2628A terminal is priced 40% below previous comparable models from H-P.

Both workstations come standard with H-P VPLUS compatible data entry feature sets. They store up to six pages of text. Maths, line drawing and 11 national-language character sets all come standard with both terminals.

Ergonomic design features include high-quality lettering on a low-glare, flicker-free display, smooth scrolling and an optional tilt-and-swivel base.

BARSON PLANS COMPUTER MANUFACTURE IN WA

Following an offer of a package of incentives by the West Australian Government, Barson Computers plans to begin manufacturing in Australia this year.

The Melbourne-based company imports BBC microcomputers from Britain and Sirius business computers from the US.

Mr Barson expressed disappointment that the Victorian Government had not offered any incentives but he did not see manufacturing based in Perth as any disadvantage, although 70% of BBC sales would be in the eastern states.

Barson Computers began selling BBC computers in Australia 18 months ago and they now claim to be selling 1000 a month. They also forecast sales of the Sirius machine to double in the second year that the company has had the agency.

Barson has drawn up manufacturing plans for the BBC micros that call for 88% Australian content.

Studies conducted by the company indicated that the cost of manufacturing in Australia would be up to 15% more than it would be in Hong Kong or other South East Asian countries because of the higher wages. However, government support, the stable political situation and the high quality of the Australian workforce would outweigh the advantages of cheaper labour.

Mr Barson believes that electronic manufacturing resources in Australia are considerably under-utilised — in some cases manufacturing equipment was only being used one or two days a month.

For further information contact **Barson Computers Pty Ltd, 335 Johnston St, Abbotsford Vic. 3067. (03)419-3033.**

TEXT EDITOR FOR HANDHELD COMPUTERS

Text-File is a text editor program for the Sharp PC-1500 or Tandy PC-2 handheld computers and is the first software release from Razor-Soft.

The program requires a computer with at least a 4K RAM expansion module installed. For the most common 8K RAM expansion, the program allows up to 85 lines of text, each 79 characters long, to be handled.

Text-File has been designed to make full use of the features of the PC-1500/PC-2 computer. The 26 character single line display is used as a window through which text is viewed. Full cursor controls allow this window to be shifted around easily.

Other review functions include requesting the display of a specific line, and a scroll function which scrolls through the whole entered text.

Two print functions are provided for use with the computer's printer.

Text-File is supplied on cassette and comes with a comprehensive instruction manual. The recommended retail price is $25. For further information contact **Razor-Soft, 1 Lantana Court, Frankston Vic 3199.**

VMEBUSS CAPABILITIES EXPANDED

Projecting a market size of $750 million for VMEbuss compatible products by 1988, executives of Mostek, Motorola and Signetics/Philips have announced technical agreement on additional key elements of the total VMEsystem architecture.

The newly-defined supporting buss structures include a high-speed memory expansion buss, VMXbuss; and a self-arbitrating high-speed serial buss, VMSbuss, which may be optionally employed in systems based on the existing VMEbuss standard.

The VMEbuss and its extension buss structures form the basis of a total VMEsystem architecture which simplifies integration of complete systems from high-performance 8-, 16-, and 32-bit board level system components. The existing VMEbuss interconnect standard provides the basic data transfer buss between major system components, while the VMXbuss facilitates expansion of local processor memory.

For rapid communication of brief messages between system modules, the VMSbuss uses only two conductors (clock and data) to provide an efficient 'party line' between system components.

Mostek and Signetics/Philips both produce the 16/32-bit M68000 MPU originally developed by Motorola. While not limited in application to 68000-based systems, the VMEsystem architecture has been designed to provide a set of system-level features desirable for microcomputer systems where the M68000 MPU family will be used most frequently.

Additional buss-support IC designs in the M68000 family have also been announced to facilitate development of VMEsystem-compatible boards and the companies project that samples of these new chips will be available in the second half of 1984.

Continuing technical discussions among the three companies are expected to result in definition of additional buss support chips to complement the overall VMEsystem architecture.

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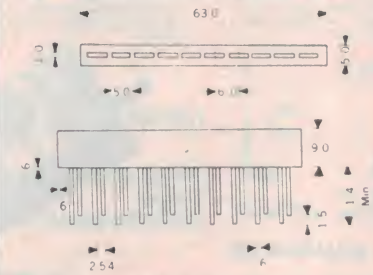

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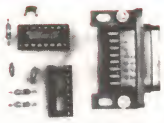

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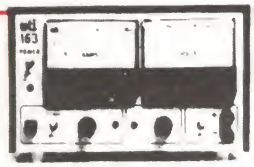

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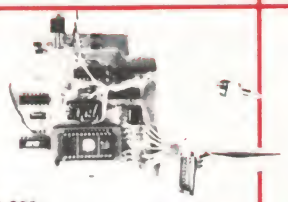

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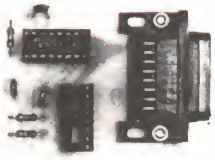

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This project will give your Apple a set of 8-bit digital inputs and outputs plus one analogue input and one analogue output. Applications include driving a robot, recording science experiment results, etc. (digital only shown).

ETI-688 BIPOLAR PROM PROGRAMMER

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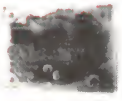
Every digital workshop should have one! Can be used to program the popular fusible-link PROMs like the 74S188, 288, 82S23 and 82S123 etc.



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This project can be used as a balanced mic amp with low impedance input, a low or high impedance input differential amplifier or a balanced input instrumentation amplifier.

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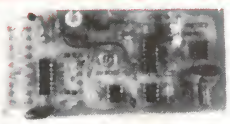

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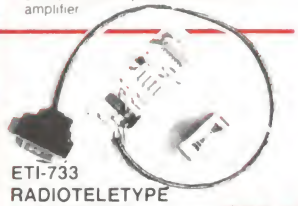

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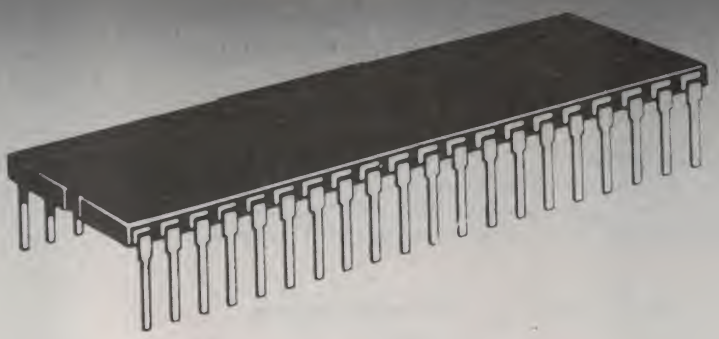
The 6800 microprocessor series

With these versatile devices in the M6800 series it is possible to design and build a minimum component system for dedicated applications.

Peter Ihnat



Part 1

THE M6800 FAMILY of LSI devices has been around for some time. Now with the release of several updated chips it is possible to design and build a system for a dedicated application with a minimum amount of time, effort and sometimes more importantly, with the minimum number of components.

This stems from the fact that there is compatibility between the different members of a family; once a particular microprocessor has been purchased almost any number of chips within the family of that microprocessor can be added to obtain the required system.

If care is taken it is also possible to use chips from other families in the same system. It seems that each new device introduced into a family by the manufacturer either performs some new function or is an existing chip which has had 'something extra' added.

The latter is the case with the MC6802 microprocessor. Basically, it is the 6800 microprocessor with two 'added extras'. Firstly, an external clock is no longer required since the oscillator is built-in. All one needs to do is to connect a crystal and two capacitors to the chip and it works.

Secondly, the designers have placed 128 bytes of user RAM on the chip (the lower 32 bytes can be placed in standby mode when the microprocessor is powered down).

Not very much RAM you say? Well, in certain applications you're right. But let's imagine that a system is required to control some specific device, e.g: a pushbutton combination lock. Ah, you say. My Apple IIe will do that. Yes, OK. But isn't that a bit of an overkill?

What would be nice is to have a small single-board microprocessor which can be configured to do the job required for tens of dollars rather than hundreds. This single board microprocessor could then be mounted in the device and left there to run it. One advantage of this method is that the microprocessor unit could be programmed to be a lot more 'intelligent' than a controller made up from discrete components.

As you probably know, large amounts of RAM may not be required in many applications. The combination lock would only need RAM to store the correct combination, entries from the keyboard and other 'housekeeping' data. The 128 bytes available in the 6802 would probably be more than enough!

Figure 1 shows one possible minimum system (keyboard and display hardware is not shown). Note that this system would not be flexible enough for the home constructor since the ROM part of the MC6846 needs to be mask-programmed during manufacture.

A more flexible system would use a PIA for I/O and an EPROM to hold the control program.

There are two other versions of the MC6802; the MC6808 is identical but does *not* have the internal RAM whereas the MC6802NS does have RAM but not the standby feature. They are all available at speeds of 1 MHz, 1.5 MHz and 2 MHz.

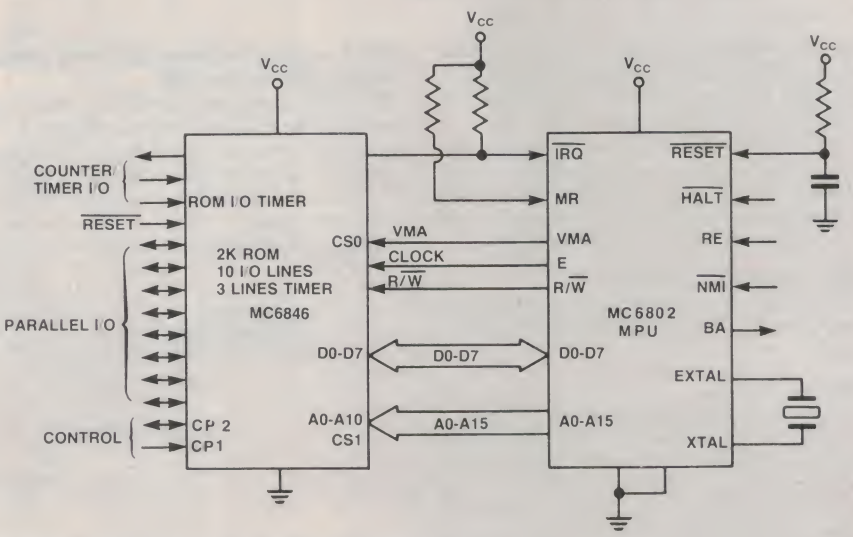
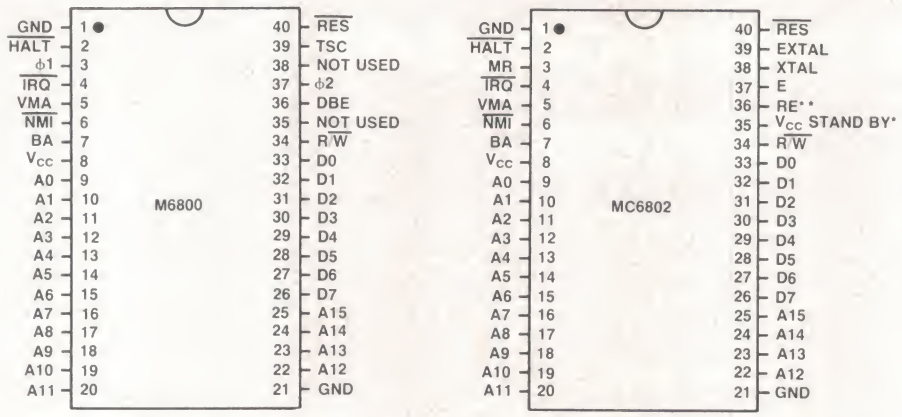


Figure 1. One example of a cost effective microcomputer.



NOTE: * PIN 35 SHOULD BE TIED TO +5 V ON THE 6802NS ** PIN 38 MUST BE TIED TO GND ON THE 6808

Figure 2: Pinouts of M6800 and MC6802 microprocessors.

Microprocessor description

From the hardware point of view the 6800 and 6802 are both available as 40-pin packages. Figure 2 shows the pinouts of the two devices. Notice that they are almost pin for pin equivalent; the differences are due to the 6802 having a clock oscillator and 128 bytes of RAM on the same chip.

It is important to note that the two devices are fully software compatible. Let's examine the function of each of the 40 pins so that differences between the 6800 and 6802 signals can be noted and explained.

pin no.	6800 signal description	6802 signal description
1	ground (GND)	ground (GND)
2	halt (HALT)	halt (HALT)
3	phase 1 (ϕ1)	memory ready (MR)
4	interrupt request (IRQ)	interrupt request (IRQ)
5	valid memory access (VMA)	valid memory access (VMA)
6	nonmaskable interrupt (NMI)	nonmaskable interrupt (NMI)
7	buss available (BA)	buss available (BA)
8	power (V_{cc})	power (V_{cc})
9-20	address lines (A0-A11)	address lines (A0-A11)
21	ground (GND)	ground (GND)
22-25	address lines (A12-A15)	address lines (A12-A15)
26-33	Data lines (D0-D7)	data lines (D0-D7)
34	read/write line (R/W)	read/write line (R/W)
35	not used	V_{cc} standby
36	data buss enable (DBE)	RAM enable (RE)
37	phase 2 (ϕ2)	enable (E)
38	not used	xtal
39	three state control (TSC)	extal
40	reset (RES)	reset (RES)

Table 1. M6800 and MC6802 pin summary.

PINS 1 and 21 — ground.
These are the ground connections and should be connected to 0 V from the power supply.

PIN 2 — $\overline{\text{HALT}}$
During normal operation of the microprocessor this input should be tied high. When pulled low the microprocessor will complete execution of the current instruction and then stop. While in this halted mode the various control lines will be set to the following states: Buss Available (BA) line set high, Valid Memory Access (VMA) line set low, Read/Write (R/W) and data lines will be tri-stated and address lines will be tri-stated in the 6800 or will display the address of the next instruction in the 6802.

PIN 3 — phase 1 clock on the 6800; Memory Ready (MR) on the 6802.
The 6800 needs an external two-phase non-overlapping clock as shown in Figure 3. The two waveforms are called phase 1 and phase 2 and are fed in via pins 3 and 37 respectively. Since the 6802 has a built-in clock the input for phase 1 clock is not necessary, whereas pin 37 is used as a clock output for synchronising data transfers with peripheral devices.

Pin 3 on the 6802 is used as an input which controls the 'stretching' of the clock output (E) signal. When MR is low, E will be stretched integral numbers of half periods which allows interfacing with slow memories. For normal operation, MR should be tied high (it can be connected directly to V_{cc}).

PIN 4 — Interrupt Request ($\overline{\text{IRQ}}$).
A low level of this input requests that the microprocessor jump to an interrupt servicing routine upon completion of the current instruction if, and only if, the interrupt mask bit in the condition code register is not set (see discussion on interrupts).

PIN 5 — Valid Memory Access (VMA).
This does not have tri-state capabilities but when high it indicates that there is a valid address on the address buss. It is usually used in combination with an address decoder to enable peripheral devices.

PIN 6 — Non Maskable Interrupt ($\overline{\text{NMI}}$).
Similar to $\overline{\text{IRQ}}$ except that the interrupt cannot be masked (see discussion on interrupts).

PIN 7 — Buss Available (BA).
This output signal is normally low but when high it indicates that the microprocessor has stopped and the signal lines are no longer under its control (those which have tri-state capability are placed in the high impedance state). This usually means that either the $\overline{\text{HALT}}$ line is low or the machine is in WAIT mode as a result of executing a WAIT instruction.

PIN 8 — V_{cc}
This is connected to +5 V from the power supply.

PINS 9 to 20, 22 to 25 — address lines.
These sixteen address lines give the microprocessor an addressing capability of 64K. The lines have tri-state capability only on the 6800.

PINS 26 to 33 — data lines.
Eight bidirectional lines which transfer data to and from peripherals. These lines have tri-state capability.

PIN 34 — Read/$\overline{\text{Write}}$ (R/$\overline{\text{W}}$) line.
The microprocessor uses this line to indicate to the peripheral devices whether it wants to perform a read or write operation. It has tri-state capability and is high when the microprocessor is performing a read operation and low during a write. It's normal standby state is read (high).

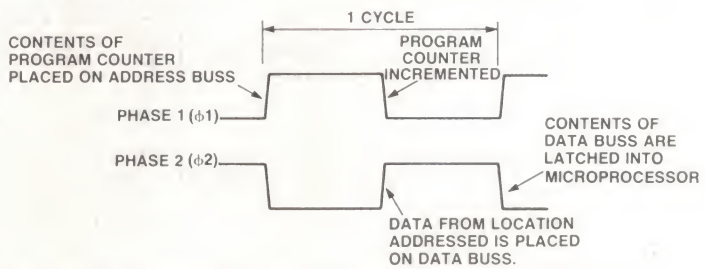


Figure 3. Two phase non-overlapping clock required for the M6800 microprocessor showing how certain operations are based around it.

PIN 35 — V_{cc} standby.
This line is only available on the 6802 (not used on the 6800) and applies the supply voltage to the first 32 bytes of the internal RAM as well as the RAM Enable (RE) logic. By ensuring that +5 V is applied to this pin when the microprocessor is powered down, data will be retained in this portion of memory.

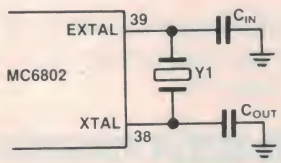
PIN 36 — Data Bus Enable (DBE) on 6800; RAM Enable (RE) on 6802.
With the 6800, a high on the DBE input line permits data to be outputted during the microprocessor write cycle. This is replaced by the RAM Enable (RE) function on the 6802.

A high on this line enables the internal RAM which is fully decoded from $0000 to $007F. If external RAM or ROM exists at these addresses, a low should be applied to RE to disable the internal RAM.

PIN 37 — phase 2 clock on 6800; Enable (E) on 6802.
These two signals are equivalent and supply the clock signal to the microprocessor and the rest of the system. Note that this pin is an input on the 6800 and an output on the 6802.

PIN 38 — not used on 6800; Xtal on 6802.
This input connects one side of an external crystal to the internal oscillator. It is used in conjunction with pin 39.

PIN 39 — Three-State-Control (TSC) on 6800; Extal on 6802.
Applying a high to this pin on the 6800 places the microprocessor's tri-state lines into the high impedance state. On the 6802, the line is used as the other input from the external crystal (see pin 38) and is connected as shown in Figure 4.



Y1	C_{IN}	C_{OUT}
3.58 MHz	27 pF	27 pF
4 MHz	27 pF	27 pF
6 MHz	20 pF	20 pF
8 MHz	18 pF	18 pF

Figure 4a. Crystal connections to the MC6802.

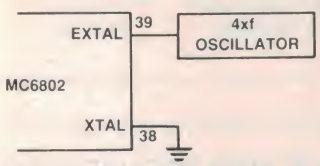


Figure 4b. External clock oscillator connection.

Since the 6802 includes a divide-by-four circuit as part of its internal oscillator, the crystal's frequency should be four times the required operating frequency, i.e: 4 MHz crystal for a 1 MHz clock cycle.

Note also that the oscillator can be driven externally with a TTL input signal running at four times the required E clock frequency. It should be fed into pin 39 and pin 38 should be grounded in this case.

PIN 40 — Reset ($\overline{RES}$).
A low placed on this input resets the microprocessor. All information stored in the registers will be lost during this period. When the line is brought up to a high again, the microprocessor performs the restart sequence which includes setting the interrupt mask bit and loading the program counter with the contents of address location $FFFE and $FFFF. Execution then begins at this specified address.

Operation of interrupts

The 6800 and 6802 microprocessors allow for three types of interrupts: maskable, nonmaskable and software (note that reset could be treated as a nonmaskable overriding interrupt since it is serviced in a similar manner to the other types). Two of the interrupts are initiated by signals applied to external connections on the chip. The software interrupt is different since it is initiated by the program. Otherwise the servicing of each of the interrupts is very similar.

When an interrupt occurs, the microprocessor will first complete the current instruction. Next the contents of the internal registers are pushed onto the stack, i.e: condition codes, accumulators A and B, index and program counter.

address (hex)	contents
FFFF	LSB of restart address
FFFE	MSB of restart address
FFFD	LSB of start address of NMI service routine
FFFC	MSB of start address of NMI service routine
FFFB	LSB of start address of software interrupt service routine
FFFA	MSB of start address of software interrupt service routine
FFF9	LSB of start address of IRQ service routine
FFF8	MSB of start address of IRQ service routine

Table 2. Location of the interrupt vector addresses.

The only exception here is the maskable interrupt where the mask bit in the condition code register is first tested to see if the interrupt is allowed. If it is allowed then the interrupt will be serviced by the method to be described, otherwise program execution proceeds as normal.

After saving the registers, the $\overline{IRQ}$ mask bit is set to inhibit any other interrupts. Then the program counter is loaded with the address of the appropriate interrupt service routine. These addresses are found in the eight highest locations in memory and are listed in Table 2. Program execution jumps to the specified location where hopefully the programmer has placed an appropriate service routine.

The interrupt service routine usually ends with the Return From Interrupt (RFI) command which tells the microprocessor that servicing is complete and that it can restore all the registers to the same status as before the interrupt. Execution then continues with the instruction that would have been executed if the interrupt hadn't occurred.

The insides

As already stated, the MC6802 is software compatible with the M6800. This implies that the internal structure is similar. Both microprocessors have six internal user registers:

accumulator A	8-bit
accumulator B	8-bit
index register	16-bit
program counter	16-bit
stack pointer	16-bit
condition code reg	8-bit

Both accumulators are used as temporary storage registers for results from logical and arithmetic operations and for data manipulation. Depending on the results of many of the operations, any of six condition codes can be set or cleared to indicate various conditions. These codes form the lower six bits of a special register and they indicate the status of these conditions: half carry, interrupt mask, negative, zero result, two's complement overflow and carry/borrow.

The program counter contains the address of the next byte to be fetched and is incremented automatically. The stack pointer is a register that contains an address where the status of the microprocessor registers can be stored when some other function needs to be performed. Bytes can be 'pushed' onto the stack (data actually stored at the address pointed to and the pointer is then decremented) or 'pulled' off the stack (the pointer is incremented and the data is read).

From the software point of view, the 6800 and 6802 have seven addressing modes which can be used by the programmer. They are: accumulator, implied, immediate, direct, extended, indexed and relative addressing modes.

These will not be discussed here but are explained quite well in the two books which are on special offer this month.

So as you can see, the MC6802 is a more versatile device than the M6800 and is well suited to forming the CPU of a minimum component system for dedicated applications. Next month we'll look at such a system. ●

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1. Bishop, Ron, *Basic Microprocessors and the 6800*, New Jersey, Hayden Book Company, Inc.
2. Staugaard, Andrew C, *How to Program and Interface the 6800*, Indiana, Howard W. Sams & Co., Inc.
3. Motorola, *MC6802 data sheet.*

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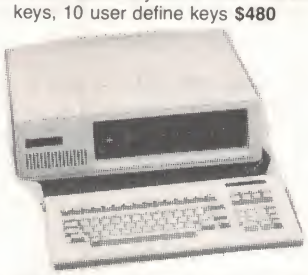

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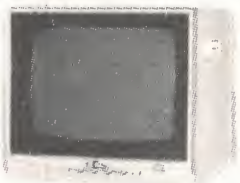

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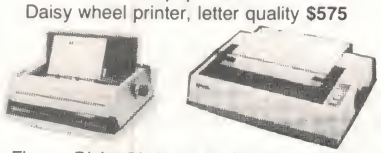

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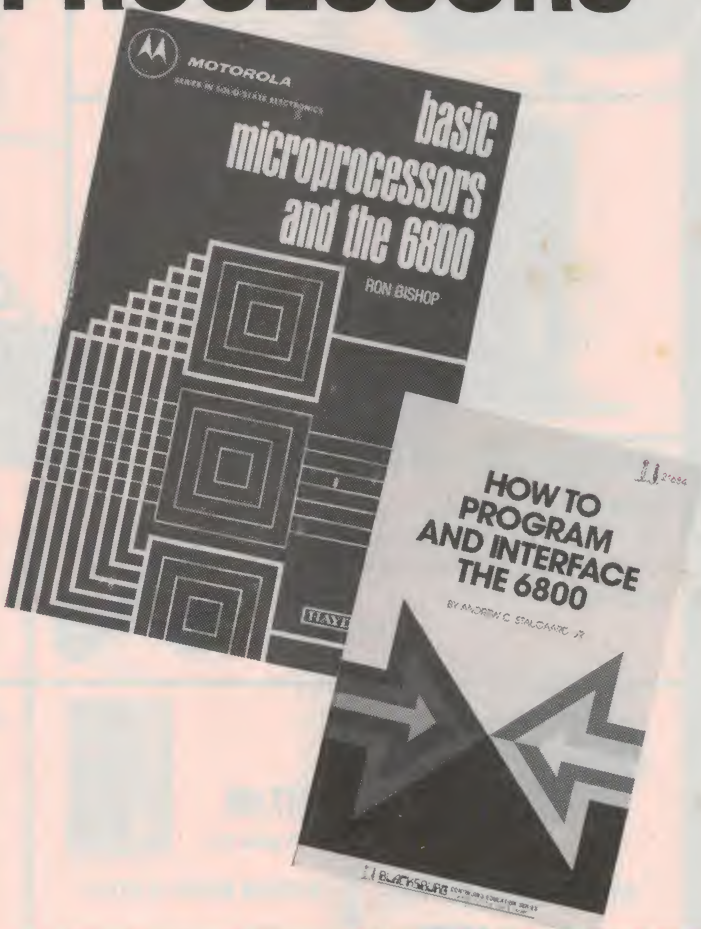

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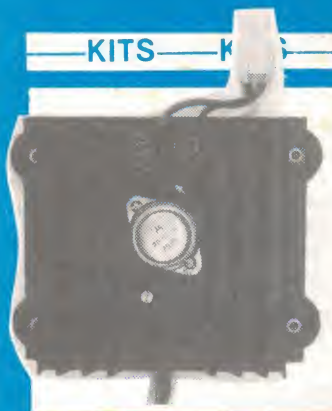

ETI-274 damn fast NiCad charger

This project is specifically designed for modellers and photographers who make heavy demands on NiCad batteries quite routinely. There's nothing more frustrating than having your RC model run out of juice as it runs out of sight, or your flash run out of flash at an inopportune moment. If you use NiCads and need a quick charge then this project is for you.

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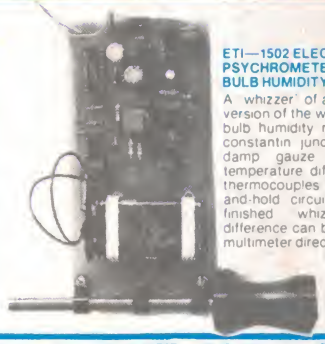

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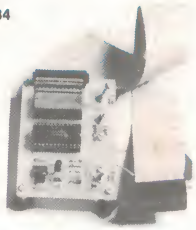

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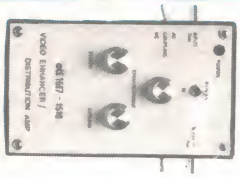

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Eight joysticks and a trackball reviewed

So you want to buy a joystick for your micro, but don't know which one to purchase (for the kids, of course!)? This review should help you come to grips with the problem.

Peter Moxom

THE ATARI-TYPE joystick has undoubtedly become the most popular format for games control on micros and video games machines. It's virtually an industry standard amongst manufacturers. However, there's *lots* of competition, with many accessory manufacturers getting 'on the bandwagon'. A huge variety of styles and models is now offered. If you're confused enough after choosing a micro or video game, you're going to be just as confused all over again trying to choose a 'better' joystick.

To clear away a fog of confusion, it was suggested to the Editor that a number of joysticks be obtained for review. All in good time, some eight joysticks arrived, along with one 'trackball'. The units reviewed were:

Atari — by Atari (the 'benchmark')
Quickshot — by Spectravideo
Mini Champ — by Championship Electronics
Super Champ — by Championship Electronics
Pointmaster — by Discwasher
The Boss — by Wico
Red Ball — by Wico
Red Stick — by Wico
Trackball — by Wico

Each unit was examined for control accuracy, fire button response, grip, construction and suitability for right and left handers alike. A VIC-20 was used as the review machine with a variety of games kindly supplied by Ramond Bermeister of The Computer Spot, Shop C4, MLC Centre, Martin Place, Sydney.

Firstly, control accuracy would have to be the most important feature of any joystick to its user because, when using a joystick for its designed purpose — games control — you want to get away from those aliens and other nasties and zap, rather than be zapped. To zap effectively, the fire button must have good response or else you're more than likely to be zapped!

Apart from the requirement of good fire button response, it must be well located. The best location for fire buttons is on the stick itself so that the joystick can be placed on a table, or other solid surface, making single-hand operation possible. The stick-located fire buttons are particularly suited to left hand users.

The table here gives a rating out of five for the four parameters, along with other pertinent details about the joysticks.

The trackball was a ring-in, supplied along with the Wico joysticks. Trackballs are relatively rare at present, probably for reasons of cost, but they have certain advantages in some applications although they don't match up to joysticks in general games control. Basically, they consist of a ball sitting on a set of rollers placed at right angles (X and Y axes). Attached to each roller mechanism is a light and detector arrangement that is 'cut' by a perforated disc. The light detector acts as a switch, in a similar manner to the switches on the joysticks.

Joysticks, internally, have four switches activated by the stick, giving eight control directions. The fire button is a separate switch.

Now for the reviews! ▶

DISTRIBUTORS

The units reviewed were kindly supplied by the following firms:

Atari and Wico: Futuretronics Australia Pty Ltd, 1076 Centre Rd, South Oakleigh, Vic. 3167.

Quickshot: Videoactiv, 70 St. Kilda Rd, St. Kilda, Vic. 3182.

Mini Champ and Super Champ: Computerplay, 16 Hertford Crescent, Wheelers Hill, Vic. 3150.

Pointmaster: Arena Distributors, 642 Albany Highway, Perth, W.A. 6000.

The Atari

The Atari only has one fire button, located on the top left of the base. The stick is very stiff in usage and very uncomfortable for long sessions. It's good for a 'benchmark', because every other manufacturer has tried to outdo it — and generally succeeded. But, it's still the cheapest!

The Super Champ

This, too, has a retractable cord that winds up in the base. The cord is a sensible length. The fire buttons are sensibly located — one trigger-style at the top of the hand grip, the other on the very top of the stick. Both have excellent response. The unit is comfortable to use in the hand. The base has suction caps so is best for table use, rather than held in one hand — which I found uncomfortable. Construction is just acceptable, the design covers this up.

The Quickshot

This one was early on the market and 'set the standard' for many others to follow. It has suction caps on the base and a contoured hand grip with fire buttons both on the base and stick. I found it hard to use as an in-hand joystick (which is the Atari's main mode) but it is good for use on a table or floor. Construction seemed flimsy, confirmed by its being prone to breakage. It's no better than the Atari in this regard.

Pointmaster

This joystick is well thought out in design and has excellent response for directional control and the fire buttons. It is also sensibly priced. The stick has more movement in the forward direction than the rearward direction, equal movement left and right, although I don't know that that's much of an advantage. If it is, it's very subtle. In general, stick movement is greater than most of the others reviewed but ensures that you move your 'piece' in the direction intended.

Construction is 'solid', above average, but not as good in this area as the best reviewed. The Pointmaster is ideal for either right or left hand users. It has only one fire button, located on top of the stick. The base is smaller than most and most comfortable to hold in your other hand, I found.

The Mini Champ

Clearly, this one was designed for competition use by under-15s. It fits small hands . . . er, like the proverbial. It has three fire button locations — one on top of the stick, two on the base. Thus, it suits right or left handed use. The cord is retractable and winds up inside the base. I found it hard to hold in my hand at first, but it became easier the more I used it. Response in control is reasonable, construction is average, somewhat better than the Atari and it's competitively priced.

The Boss

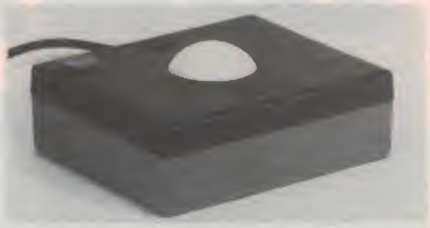
Mady by Wico this joystick is distributed by *the* video games company in Australia — Futuretronics. The grip on this stick is suited not for small hands, but *minute* hands (obviously aimed at the Irish Leprechaun market). The single fire button, located atop the stick, is hard to get your thumb around as it is tall and square and exhibits no 'feedback'. Control accuracy is good, but maimed by the grip. In all, a *very* disappointing product from Wico who normally produce an excellent product.

The Red Stick

Aptly named, this is another one from Wico. This must be the best joystick I've ever used — it has *unbelievable* response in directional control and with the fire button. Left handers should have no problems with this one as there is a fire button atop the stick. Movement is *very* smooth — only hampered by the price! Five marks in all categories.

The Red Ball

Brother to the Red Stick, again from Wico. Another 'miracle' joystick, it only lets the side down in the grip. I found it hard to get a good grip, at first, but once perfected it's as good as the Red Stick.



The Trackball

Yet another Wico creation. I think this is really a gimmick for games control in that, in general, it's hard to control — particularly at speed, and is only suited to right hand players. I found it over-sensitive, a sneeze will throw your piece right off course. Once the novelty wears off, it's only another one for the toy heap at the bottom of the wardrobe. This is unfortunate because some games are suited to a trackball style of control. If the price weren't so high, it would probably be a big hit, I suspect.

Conclusion

In concluding, I would like to say that the Wico Red Stick is leaps and bounds ahead of the rest of the field, but it costs $45, which is a consideration. When considering value for money the Pointmaster, I feel, would definitely be the best. At only $25 (5c change), it is an excellent buy. ●

	ATARI	QUICKSHOT	MINI CHAMP	SUPER CHAMP	POINTMASTER	THE BOSS	WICO REDSTICK	WICO REDBALL	WICO TRACKBALL
CONTROL ACCURACY	2	3	3	4	5	4	5	5	2
BUTTON RESPONSE	2	3	3	5	5	3	5	5	5
GRIP	1	3	4	4	5	2	5	4	N.A.
CONSTRUCTION	2	2	3	3	4	4	5	5	5
CORD LENGTH (metres)	1.22	1.24	1.21	2.95	1.61	1.64	1.53	1.56	1.68
L or R HANDED	R	R or L	R or L	R or L	R or L	R or L	R or L	R or L	R
FIRE BUTTON LOCATION(S)	BL	BL, ST	BL, BR, ST	ST, SG	ST	ST	BL, ST	BL, ST	BL
NO. OF BUTTONS	1	2	3	2	1	1	2	2	1
PRICE (rrp)	$19.95	$24.95	$24.95	$29.95	$24.95	$29.95	$44.95	$49.95	$89.95

NOTES: BL = bottom left; BR = bottom right; ST = stick top; SG = stick grip.

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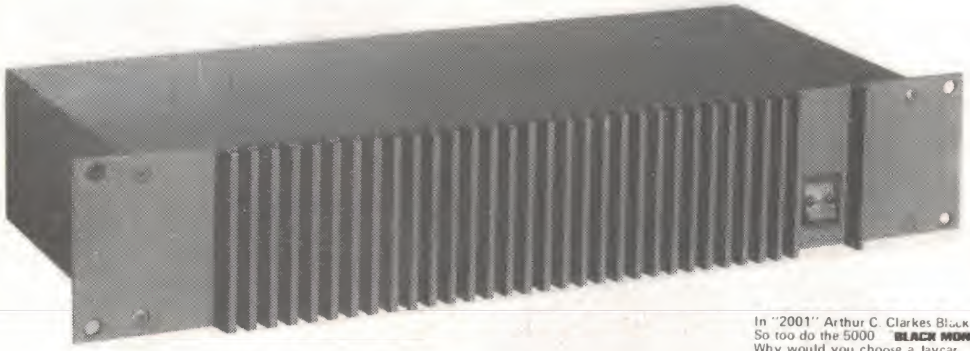

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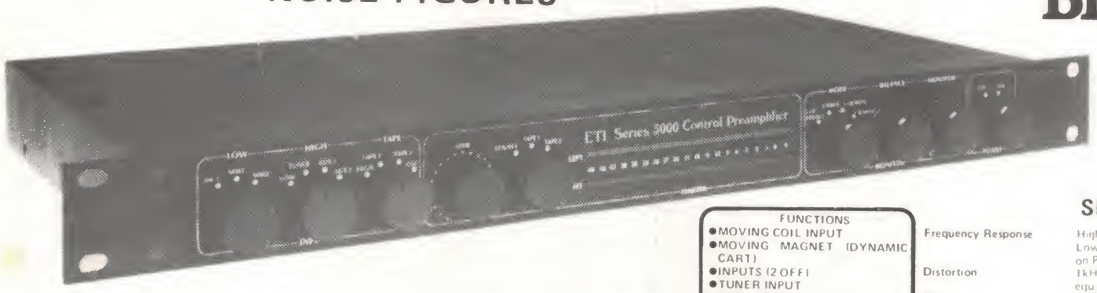
HUM	-100dB below full output (flat)
NOISE	-116dB below full output (flat, 20kHz bandwidth)
2nd HARMONIC DISTORTION	<0.001% at 1kHz (0.0007% on prototypes) at 100W output using a +56V supply rated at 4A continuous <0.003% at 10kHz and 100W <0.0003% for all frequencies less than 10kHz and all powers below clipping
3rd HARMONIC DISTORTION	Determined by 2nd harmonic distort on (see above)
TOTAL HARMONIC DISTORTION	<0.003% at 100W (50Hz and 7kHz mixed 4:1)
INTERMODULATION DISTORTION	
STABILITY	Unconditional

5000 CONTROL PREAMPLIFIER

FEATURING A MOVING COIL CARTRIDGE PREAMP WITH UNBELIEVABLY LOW NOISE FIGURES

"BLUEPRINT"

REF: ETI JUNE/OCT 1981



CAT KE 4202

The refinement to this preamp has been incredible. At one stage we had two versions of the preamp but people were only interested in the Blueprint. Now we only have the Blueprint.
Why is the Blueprint so good? Well, there are many reasons but a few of the main ones: Firstly, we use a far, far superior screened cable in the kit. It is much lower in capacitance than the cheap imported excuse for screened cable found in ALL other versions that we have seen. This cable is made in Australia especially for us and costs over 5 times more than the imported junk. When you consider that over THIRTY FEET of screened cable runs around inside the preamp you will appreciate the low capaci tance cable. High capacitance cable in signal lines could effect high frequency performance.
We use a specially selected version of the LM394 ultra-matched transistor for the moving coil preamp. It is a whisker better than the other LM394's and part of our Blueprint philosophy.
We employ HARD (not soft) gold plated RCA input sockets on ALL INPUTS (previously just M.C.). Probably a bit extravagant (except M.C.), we think, but nice. A pair of solid metal, gold plated RCA line sockets are provided to connect to your M.C. cartridge. Special Nylon mounting grommets are provided for all input and output sockets. Far superior to squashy and perishable rubber grommets provided in other kits. Extra touchs like roller tinned PCB's (to reduce dry or noisy solder joints), 1% metal film resistors, quality I.C. sockets where practicable, English 'torlin' low noise selector switches, special rear panel, solid machined matching aluminium knobs and specially polished rectan gular (multicoloured) LEDs add up to a classic kit.
Like the Black Monolith the Blueprint is the intelligent choice. Even if you were a millionaire and could afford anything you probably would do no better spending virtually any amount of money more.

THE BLUEPRINT IS UNBELIEVABLE VALUE FOR MONEY AT ONLY $299 FOR THE COMPLETE KIT

FUNCTIONS
- MOVING COIL INPUT
- MOVING MAGNET (DYNAMIC CART)
- INPUTS (2 OFF)
- TUNER INPUT
- AUX INPUTS (2 OFF)
- TAPE INPUTS (2 OFF)
- INPUT LEVEL CONTROL
- TAPE OUTPUTS (2 OFF)
- 400Hz CALIBRATION OSCILLATOR
- LED AVERAGE (VU) & PEAK
- LEVEL METERS -48dB TO +9dB
- MODE SWITCH, STEREO BALANCE CONTROL LINE OUT, MONITOR OUT, MONITOR VOLUME CONTROL

FEATURES
- EXTREMELY CLOSE TRACKING TO RIAA PHONO EQ
- GOLD PLATED CONNECTORS ON ALL INPUTS
- ENGLISH 'LORLIN' LOW NOISE SELECTOR SWITCHES
- LOW NOISE 1% 50ppm METAL FILM RESISTORS USED
- TINNED FIBREGLASS PCB's
- LOW CAPACITANCE SCREENED CABLE USED THROUGHOUT
- QUALITY I.C. SOCKETS
- SPECIAL REAR PANEL
- MULTICOLOURED RECTANGULAR LEDs USED

SPECIFICATIONS

Frequency Response	High level input: 15Hz-130kHz, +0, -1dB Low level input: conforms to RIAA equalisation +0.2dB (see detail on Phono specs.)
Distortion	1kHz <0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation)
S/N noise	High level input, master full, with respect to 300mV input signal at full output (1.2V): -92dB flat, -100dB A weighted. MM input, master full, with respect to full output (1.2V) at 5mV input, 500 ohm source resistance connected: -86dB flat, -92dB A weighted. MC input, master full, with respect to full output (1.2V) and 200uV input signal: -71dB flat, -75dB A weighted.

ETI 478MM MOVING MAGNET INPUT STAGE

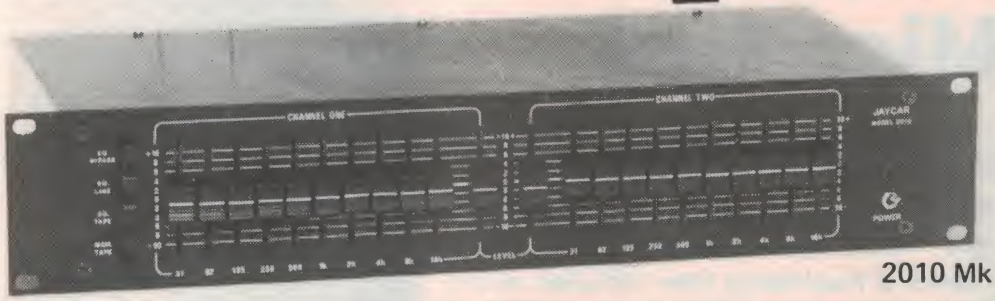
Gain	74, 1kHz
Frequency Response	Conforms to RIAA Equalisation +0.2dB
Total Harmonic Distortion	<0.001%, 1kHz, 10mV RMS input
Headroom	>28dB with respect to 5mV RMS input signal, i.e. 135mV RMS
Noise	Total equivalent input noise, 122nV 'A' input shorted 216nV flat, input shorted

S/N ratio	1mV	5mV	10mV
Flat	73dB	87dB	93dB
A weighted	78dB	92dB	98dB

ETI 478MC MOVING COIL INPUT STAGE

Gain	24
Frequency Response	7Hz - 135kHz +0, -1dB
Total Harmonic Distortion	<0.003%, 1kHz, 30mV input
Noise	Total equivalent input noise 83nV flat, input shorted 42nV 'A' input shorted 56nV flat, after RIAA Eq, input shorted 34nV 'A' after RIAA Eq, input shorted

JAYCAR QUALITY



ONLY $139

2010 Mk IIA

For those whose budget does not extend to $389, may we suggest the 2010 MkIIA Octave (10 band) Equaliser. This unit is rack mounted in the same format as the 5000 series Equaliser. It is stereo (in one 3½" high cabinet) with one slider per octave.
It represents a refinement of the ETI 485 graphic and, as you can see is no slouch when it comes to performance.

The 2010 is a two channel graphic equaliser featuring 10 adjustable controls on octave centre frequencies (independent for each channel). Each control provides up to ± 14dB of adjustment. Each channel is also equipped with a level match control giving an overall gain of adjustment of ± 14dB.
The functional versatility of the 2010 equaliser is unsurpassed. Eight modes of operation are available from the push button switches on the front panel.
Included amongst these are the ability to equalise both recording and playback when dubbing tapes.
The 2010 has been designed to be compatible with all commercially available equipment and is ideal for use in a Hi Fi system or P.A. system.

CAT KE 6535

SPECIFICATIONS

ELECTRICAL (EACH CHANNEL)	
FREQUENCY RESPONSE	
EQ LINE OR TAPE	±0.5dB 10Hz to 20kHz Controls flat
EQ BYPASS	Flat
SIGNAL TO NOISE RATIO	
2 VOLTS OUT CONTROLS FLAT	Greater than 87dB
TOTAL HARMONIC DISTORTION	
1 VOLT OUT CONTROLS FLAT	Less than .04 20Hz to 20kHz
OUTPUT IMPEDANCE	100 ohms
RATED OUTPUT	2 Volts RMS into 10K Load
OUTPUT AT CLIPPING	10 Volts RMS
INPUT IMPEDANCE	50K Nominal
MAXIMUM INPUT VOLTAGE	10 Volts RMS
EQ CENTRE FREQUENCIES	31 62 125 250 500 1K 2K 4K 8K 16K Hz ± 10%
RANGE OF CONTROLS	
INDIVIDUAL FILTERS	±12dB at Centre Frequency
LEVEL MATCH	±10dB

CONTROLS	
EQUALISATION	10 Vertical Slide Controls for each channel
LEVEL	Vertical Slide Control each Channel
EQ BYPASS	Pushbutton Switch
EQ LINE	Pushbutton Switch
EQ TAPE	Pushbutton Switch
MONITOR TAPE	Pushbutton Switch
POWER	Pushbutton Switch with LED indicator
TERMINATIONS	Rear panel RCA sockets for both input and output connections
PHYSICAL	
DIMENSIONS	483mm x 89mm x 152mm (19" x 3½" x 6")
WEIGHT	4 kg
FINISH	Front panel brushed, black anodised Aluminium silk screened lettering. Black Marviplate cheeks

"JOYSTICK BARGAIN"

As you see it. Works well fitted with 9 pin 'D' connector.
Can be cut off for connection of other connectors.

Cat. No. XA5630

$19.95

Infra-Red Movement Detector

The infra-red or IR Detector for short, falls into the Black Magic category. It basically is a high gain passive tuned receiver of a particular IR band. The heart of the unit consists of a high gain lens (antenna?) which has a "Commutated" field of view. Its reception pattern is count-like, but highly tuned to the IR wavelength of human bodies.

When a human passes within proximity of the pick-up area, the lens will selectively pick up IR radiation and then not.

Movement across the pick-up area will result in a series of pulses sent to a detector circuit.

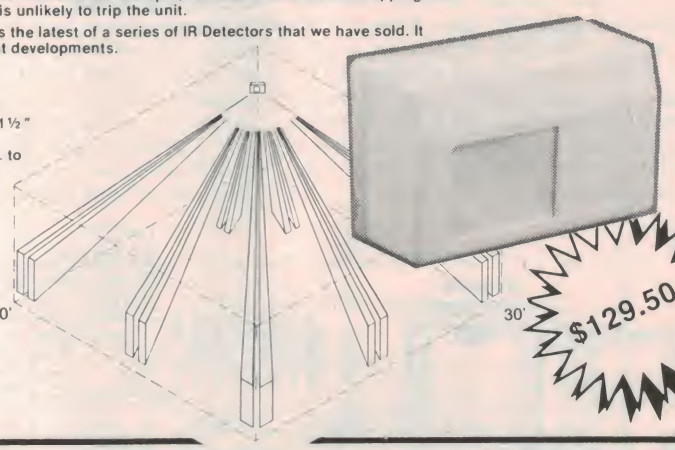
IR detectors are very reliable as they do not transmit and will not respond to non heat radiating objects. Curtains for example, can wave about without tripping the alarm. Even the cat is unlikely to trip the unit.

The "Arrowhead" is the latest of a series of IR Detectors that we have sold. It represents the latest developments.

Features:

- 40 x 30' Range
- 12V D.C. Powered.
- Small 4½" x 2" x 1½"
- Double Sensor
- Computerised Q.C. to Lower failure rate
- Built in test lamp
- Tamperswitch Included
- Alarm Output JPST 30 V DC @ 1 AMP.

Cat. No. LA5017



$129.50

THE RED FLASHER

Car theft has risen dramatically recently, is your car safe? Thieves stay away from cars which have those expensive flashing light alarms. The ones with the red square pushbutton switch that flashes.

Now you can make your car look like it has one of those alarms, whether you have one or not.

We supply a quality Swiss pushbutton illuminated square switch and the electronics to make it flash. We even put in two deterrent stickers.
ALL THIS PEACE OF MIND FOR ONLY $20.95.

KJ 7000.

IGNITION KILLER FOR CARS

See EA Feb. '83

This kit could well save your car from being one of the 70,000 cars stolen each year in Australia.

The kit is simply connected in parallel with the points.

Easy to build.

Complete with two deterrent stickers.

Cat. No. KA1535

$14.95

Jaycar Incorporating 40' ELECTRONIC AGENCIES

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NUMBER 1 FOR KITS

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$100 – $198 ($8.00)	Over $199 ($10)

"Free INSURANCE for Road & Registered Post over $200"
All heavy or bulky items (over 20kg.) sent Comet Road Freight $12.00 anywhere in Australia.

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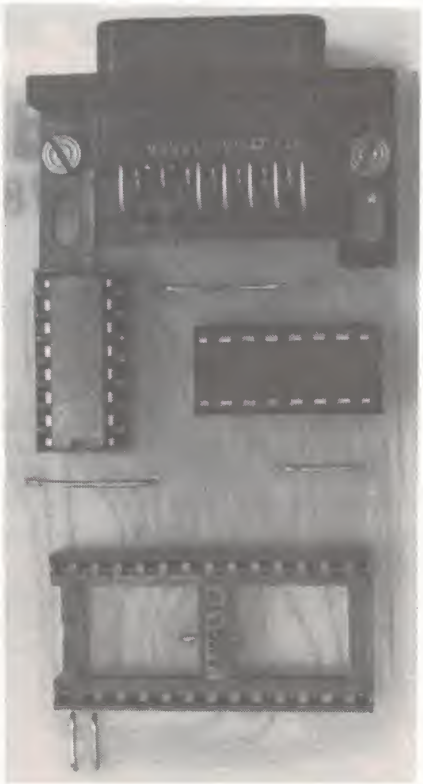
MAIL ORDERS AND CORRESPONDENCE – P.O. Box 185, Concord, 2137

Mail Order By BANKCARD Via Your Phone

A ROM reader for the Microbee



So you've written your 32K 'Adventure' program and you're impressing all your friends with the graphics and the witty text — but they're not impressed at how long it takes to load the goldang program from tape! Then again, loading those short, useful utilities from tape takes a frustrating few minutes when you're hot to get on with the job. This project fixes that — transfer those tape programs to EPROM and load them with the ROM Reader.

Paul Leonardi

THIS PROJECT enables your favourite games or utilities to be loaded into your Microbee very quickly and cheaply. At the moment, if you want to change programs in the Microbee, you must either wait agonising minutes for an 8K program to load from cassette, or if you want it faster, a disk drive and associated software is needed (rather expensive for most of us). The ETI-673 MultiPROM board described in the November 1982 issue is another approach but is limited to a number of programs and the program must be written for a certain area of memory.

The ROM Reader was designed to enable you to read a program previously written for tape storage and then transferred to EPROM. The project plugs into the 15-pin D-socket on the Microbee's rear apron and requires no external power. The program you wish to read into memory must have previously been put into a 2716, 2732 or a 2764 EPROM. If the ETI-668 Microbee EPROM blower is available, you can quite easily do this by reading the program from tape and copying to EPROM with a few small modifications to the code. This way, a library of EPROMs can be kept, similarly to your library of tapes.

A machine code support program is necessary to read the information into memory quickly. A USR (XXXX) call from BASIC is all that is necessary to read in and execute the program as the first seven locations of the EPROM contain the type and load address information.

PARTS LIST — ETI-678

Resistors ..... nil!
Capacitors ..... nil!
Semiconductors
IC1 ..... 74LS257
IC2 ..... 4040B

Miscellaneous
ETI-678 pc board; 28-pin ZIF socket or 28-pin low insertion pressure socket; DA15P right-angle pc mount 15-pin plug; tinned copper wire for links.

Price estimate: $23-$30

Details

The design is very simple, as you can see from the circuit diagram. However, I've pulled a few tricks. The Microbee's parallel I/O port has only eight signal lines. To read eight data lines from the EPROM, select each address location in turn and do whatever else is necessary, I have arranged the Microbee I/O lines to be a 4/in/4-out set, multiplexing the eight EPROM data lines onto the four Microbee input lines set up. Naturally, some 'driving' software is needed.

Driving software

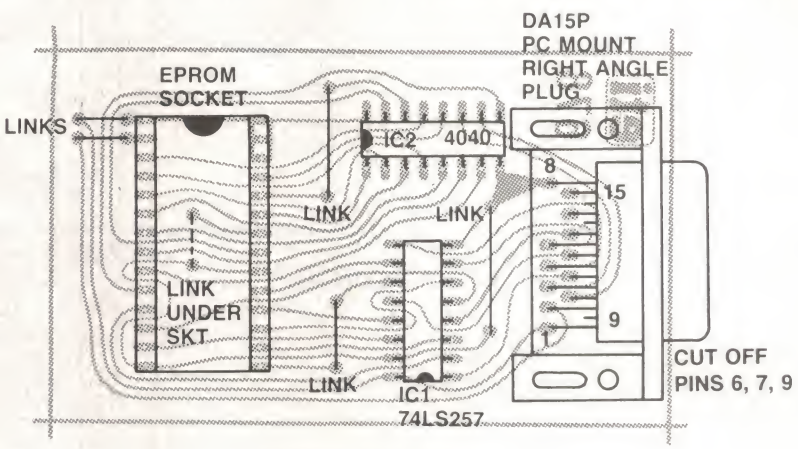
The program which enables the EPROM to be read can be ORGed to reside in RAM and thus needs to be loaded from cassette occasionally or reside in the NETWORK EPROM socket.

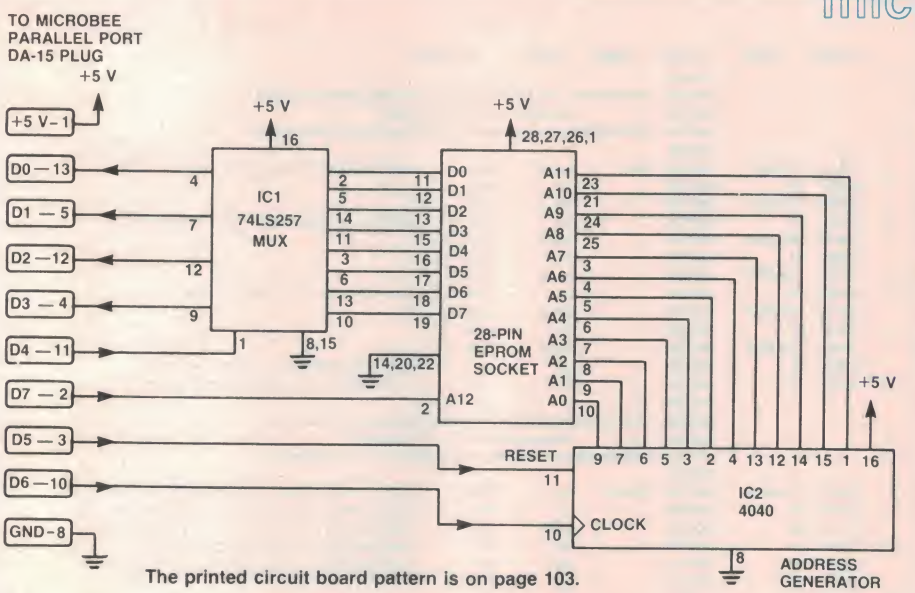
The software initially sets up the PIO for 4-in and 4-out lines. It then resets the address generator, sets A12 low and selects the least significant nibble (half a byte, four bits). The first location in the EPROM describes the EPROM type: 4 for a 2732 (4K), 8 for a 2764 (8K). If the data is zero then a 2716 is assumed. A11 is connected to Vpp and this must be high to read a 2716, so the address generator is clocked 2048 times to set A11 high. If a 2 is the first data in the EPROM then the next step is carried out, else an error message is displayed.

The 4040 is clocked to address the EPROM's next location, the data read by setting and resetting the MUX select line (pin 1) — this byte is the most significant byte of the address to where the program is to be loaded. The next location contains the least significant byte of the load address. The following two locations specify the number of bytes to be transferred and the next two contain the program start address. The actual program resides after the initial seven bytes.

Construction

Assembling the project is quite easy. First, pins 6, 7 and 9 of the DB16P need to be cut off and discarded so that the socket can be mounted to the pc board. The way tracks had to run on the board made this necessary. Carefully check the pc board to see that all holes are correctly drilled and that there are no breaks in the tracks or hairline





The printed circuit board pattern is on page 103.

HOW IT WORKS — ETI-678

To enable only eight I/O lines to read eight data lines from the EPROMs, resent the address generator, clock the address generator and select A12 on 2764's, the port I/O A lines are arranged to be four in and four out.

The eight data lines are multiplexed by IC1, a 74LS257, on the four input lines to the Microbee (D0-D3) and one output line (D4) is used to select the higher or lower nibble (4 bits) when reading.

Two output lines reset and clock the 12-bit ripple counter IC2, a 5050, used as an address generator. The last output is used to address A12 as the address generator only goes to A11.

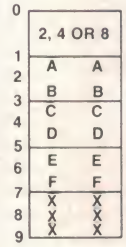
The driver software which enables the data to be read into the Microbee is described in the software section. Power is derived from the Microbee, via pin 1 of the DB15 connector.

'bridges', particularly where tracks or pads are closely-spaced. See that you can screw the DB15 plug to the board without straining the pins. Don't mount it just yet, though.

The six links need to be inserted and soldered in place first. Don't forget the one beneath the EPROM socket. While two IC sockets were used on the prototype shown in the photograph, they aren't essential. If you're using them, put them on next, otherwise, mount the EPROM socket. You have three alternatives here: the expensive way, the less expensive way and the cheap way. The expensive way is to buy a 28-pin *zero insertion force* socket. It's elegant, handy to use and saves your valuable EPROMs from harm. But they cost $15-$20. The less expensive way is to use a *low insertion force* socket. They're easy to use, the EPROMs slip in and out comfortably, reducing the risk of damaged pins, and they cost under $10. The cheap way is just to use an ordinary IC socket and take care. Use a good quality IC socket if you must go for the cheap option.

Fit the DB15 plug next, bolt it to the board before soldering the pins to avoid placing strain on the soldered joints.

Assemble the ICs to the board last of all, taking care with their orientation. The 4040 is a CMOS type, so only handle it by the ends of the package, using your thumb and forefinger, and avoid touching the pins. Better still, use a static-safe IC insertion tool. If you're soldering it in, solder pins 8 and 16 first — in that order. Use a soldering iron with a grounded tip.



2 FOR A 2716, 4 FOR A 2732, 8 FOR A 2764

AABB = HEX LOAD ADDRESS

CCDD = NO. OF BYTES IN PROGRAM

EEFF = AUTO START ADDRESS
= 8021 FOR RETURN TO BASIC

PROGRAM CODE

Testing

Plug the unit into the Port A socket of the Microbee. Insert a pre-programmed EPROM. If the driver software resides in the NETWORK socket, a simple MEM command from the BASIC command level will read in and execute the program, else a USR (XXXX) to where you have assembled the program will be needed.

Swift and happy ROM reading to you!

```
ADDR   CODE     LINE    LABEL   MNEM    OPERAND

                00100 ;****************************************
                00110 ;       EPROM READING PROG.
                00120 ;       BY P.J.LEONARDI
                00130 ;****************************************
                00140
0010            00150 BSEL    EQU     Ø10H    ;MUX SELECT BIT
0020            00160 BRESET  EQU     Ø20H    ;4040 RESET BIT
0040            00170 BCLOCK  EQU     Ø40H    ;4040 CLOCK BIT
0080            00180 BAD12   EQU     Ø80H    ;ADD. A12   BIT
                00190
                00200 ;****************************************
E000            00210         ORG     0E000H  ;E000 FOR NETWORK SPACE
                00220
                00221 ;****************************************
                00222 ;       MAIN PROGRAMM STARTS HERE
                00223 ;****************************************
                00224
E000 C303E0     00230 MEM     JP      START   ;TO PREVENT Option not fitted ERROR
E003 CD15E0     00240 START   CALL    INIT    ;INITIALIZE PIO AND 4040
E006 CD25E0     00250         CALL    TYPE    ;DETERMINE EPROM TYPE
E009 CD3CE0     00260         CALL    INFO    ;GET DESTINATION,LENGTH,START ADDR.
E00C D5         00270         PUSH    DE      ;SAVE START ADDR. ON STACK
E00D 11F90F     00280         LD      DE,4096-7       ;FIRST 7 LOCATIONS DATA
E010 CD55E0     00290         CALL    TRANS   ;TRANSFER CONTENTS TO MEMORY
E013 E1         00300         POP     HL      ;GET START ADDR. FROM STACK
E014 E9         00310         JP      (HL)    ;JUMP TO START ADDR.
                00320
                00330
                00340 ;******************************
                00350 ;       INITIALIZE
                00360 ;******************************
                00370
E015 3EFF       00380 INIT    LD      A,ØFFH
E017 D301       00390         OUT     (1),A   ;SELECT PIO MODE 3
E019 3E0F       00400         LD      A,ØFH
E01B D301       00410         OUT     (1),A   ;SELECT MS NIBBLE AS OUTPUT
                00420                 ;  AND  LS NIBBLE AS INPUT
E01D 3E20       00430         LD      A,BRESET
E01F D300       00440         OUT     (Ø),A   ;RESET THE 4040 COUNTER
E021 AF         00450         XOR     A       ;CLEAR A
E022 D300       00460         OUT     (Ø),A   ;CLEAR THE RESET LINE
E024 C9         00470         RET             ;INITIALIZE COMPLETE
                00480
                00490 ;****************************************
                00500 ;       EPROM TYPE DETERMINATION
                00510 ;****************************************
                00520
E025 CD6BE0     00530 TYPE    CALL    GET1    ;GET DATA FROM EPROM (1 BYTE)
E028 FE00       00540         CP      Ø       ;IS DATA=Ø
E02A CC96E0     00550         CALL    Z,A2716 ;YES, ASSUME A 2716 EPROM
E02D FE02       00560         CP      Ø2      ;IS DATA=2
E02F C8         00570         RET     Z       ;EPROM=2716 ie. VALID
E030 FE04       00580         CP      Ø4      ;IS DATA=4
E032 C8         00590         RET     Z       ;EPROM=2732
E033 FE08       00600         CP      Ø8      ;IS DATA=8
E035 C8         00610         RET     Z       ;EPROM=2764
E036 2174B7     00620         LD      HL,ØB774H       ;ADDRESS OF "SYNTAX" MESS.
E039 CD56A2     00630         CALL    ØA256H  ;PRINT ERROR MESSAGE AND GOTO BASIC
```

```
ADDR   CODE     LINE   LABEL  MNEM    OPERAND
                Ø0640
                Ø0650 ;****************************************
                Ø0660 ;        PROGRAM INFORMATION
                Ø0670 ;****************************************
                Ø0680
E03C CD6BE0     Ø0690 INFO     CALL    GET1     ;GET EPROM DATA AND CLOCK 4040
E03F 67         Ø0700          LD      H,A
E040 CD6BE0     Ø0710          CALL    GET1
E043 6F         Ø0720          LD      L,A      ;HL=LOAD ADDRESS OF PROGRAMME
E044 CD6BE0     Ø0730          CALL    GET1
E047 47         Ø0740          LD      B,A
E048 CD6BE0     Ø0750          CALL    GET1
E04B 4F         Ø0760          LD      C,A      ;BC=LENGTH OF PROGRAMME
E04C CD6BE0     Ø0770          CALL    GET1
E04F 57         Ø0780          LD      D,A
E050 CD6BE0     Ø0790          CALL    GET1
E053 5F         Ø0800          LD      E,A      ;DE=PROGRAMME START ADRESS
E054 C9         Ø0810          RET              ;INFORMATION COMPLETE
                Ø0820
                Ø0830 ;****************************************
                Ø0840 ;        TRANSFER DATA TO MEMORY
                Ø0850 ;****************************************
                Ø0860
E055 CD6BE0     Ø0870 TRANS    CALL    GET1     ;GET DATA FROM EPROM AND CLOCK 4040
E058 77         Ø0880          LD      (HL),A   ;PUT DATA INTO LOAD ADDRESS POINTER
E059 ØB         Ø0890          DEC     BC       ;DECREMENT LENGTH TO GO COUNTER
E05A 1B         Ø0900          DEC     DE       ;DECREMENT A12 OFF COUNTER
E05B 23         Ø0910          INC     HL       ;INCREMENT LOAD ADDRESS POINTER
E05C 7A         Ø0920          LD      A,D
E05D B3         Ø0930          OR      E        ;IS DE=0000
E05E 2005       Ø0940          JR      Z,MA12   ;YES  SET A12 HIGH
E060 78         Ø0950 CONT     LD      A,B
E061 B1         Ø0960          OR      C        ;IS BC=0000 IE PROGRAMM TRX COMPLETE
E062 20F1       Ø0970          JR      NZ,TRANS         ;NO SO DO IT AGAIN SAM
E064 C9         Ø0980          RET              ;PROGRAMME TRANSFER COMPLETE
E065 3E80       Ø0990 MA12     LD      A,BAD12  ;A12 BIT
E067 D300       Ø1000          OUT     (Ø),A    ;SET A12 HIGH ON EPROM
E069 18F5       Ø1010          JR      CONT     ;CONTINUE WITH  TRANSFER
                Ø1020
                Ø1030
                Ø1040 ;****************************************
                Ø1050 ;        GET 1 BYTE OF DATA FROM EPROM
                Ø1060 ;        AND CLOCK THE ADDRESS GENERATOR
                Ø1070 ;****************************************
                Ø1080
E06B C5         Ø1090 GET1     PUSH    BC       ;SAVE BC ON STACK
E06C DB00       Ø1100          IN      A,(Ø)    ;LOOK FOR A12 STATUS
E06E E680       Ø1110          AND     BAD12    ;RETAIN A12,LOSE MUX SELECT AND CLOC
K
E070 D300       Ø1120          OUT     (Ø),A    ;SELECT LS NIBBLE
E072 DB00       Ø1130          IN      A,(Ø)    ;READ IT
E074 E60F       Ø1140          AND     ØFH      ;MASK OUTPUTS
E076 47         Ø1150          LD      B,A      ;SAVE IN BREG
E077 DB00       Ø1160          IN      A,(Ø)    ;RETAIN A12
E079 F610       Ø1170          OR      BSEL     ;SET SELECT HIGH
E07B D300       Ø1180          OUT     (Ø),A    ;SELECT MS NIBBLE
E07D DB00       Ø1190          IN      A,(Ø)    ;READ IT
E07F CB27       Ø1200          SLA     A
E081 CB27       Ø1210          SLA     A
E083 CB27       Ø1220          SLA     A
E085 CB27       Ø1230          SLA     A        ;PUT MS NIBBLE IN MS NIBBLE OF A
E087 80         Ø1240          ADD     A,B      ;ADD MS NIBBLE TO LS NIBBLE
E088 47         Ø1250          LD      B,A      ;SAVE DATA IN BREG
E089 DB00       Ø1260          IN      A,(Ø)    ;RETAIN A12
E08B F640       Ø1270          OR      BCLOCK   ;SET CLOCK BIT HIGH
E08D D300       Ø1280          OUT     (Ø),A    ;CLOCK THE ADDRESS GENERATOR
E08F E680       Ø1290          AND     BAD12    ;REATIN A12,CLEAR OTHER OUTPUTS
E091 D300       Ø1300          OUT     (Ø),A    ;RESET CLOCK BIT
E093 78         Ø1310          LD      A,B      ;A REG = DATA NEEDED
E094 C1         Ø1320          POP     BC       ;GET BC REG BACK
E095 C9         Ø1330          RET              ;DATA IN A REG AND 4040 CLOCKED
                Ø1340
                Ø1350
                Ø1360 ;************************************
                Ø1370 ;        2716 EPROM SPECIAL TREATEMENT
                Ø1380 ;************************************
                Ø1390
E096 01FF07     Ø1400 A2716    LD      BC,07FFH         ;2047 CYCLES
E099 CD6BE0     Ø1410 A21      CALL    GET1             ;CLOCK 4040
E09C ØB         Ø1420          DEC     BC               ;DECREMENT COUNTER
E09D 78         Ø1430          LD      A,B
E09E B1         Ø1440          OR      C                ;IS BC=0?
E09F 20F8       Ø1450          JR      NZ,A21           ;NO DO IT AGAIN
E0A1 CD6BE0     Ø1455          CALL    GET1
E0A4 C9         Ø1460          RET                      ;A11 OF 4040 IS NOW HIGH
                Ø1470                                   ;TO ENABLE EPROM COMPATABILI
TY
                Ø1480                                   ;A11 ON 2716=VPP AND MUST
                Ø1490                                   ;BE HIGH TO READ IT
                Ø1500
                Ø1510
0000            Ø1520          END
00000 Total errors

A21     E099    CONT    E060    MA12    E065    A2716   E096
GET1    E06B    TRANS   E055    INFO    E03C    TYPE    E025
INIT    E015    START   E003    MEM     E000    BAD12   0080
BCLOCK  0040    BRESET  0020    BSEL    0010
```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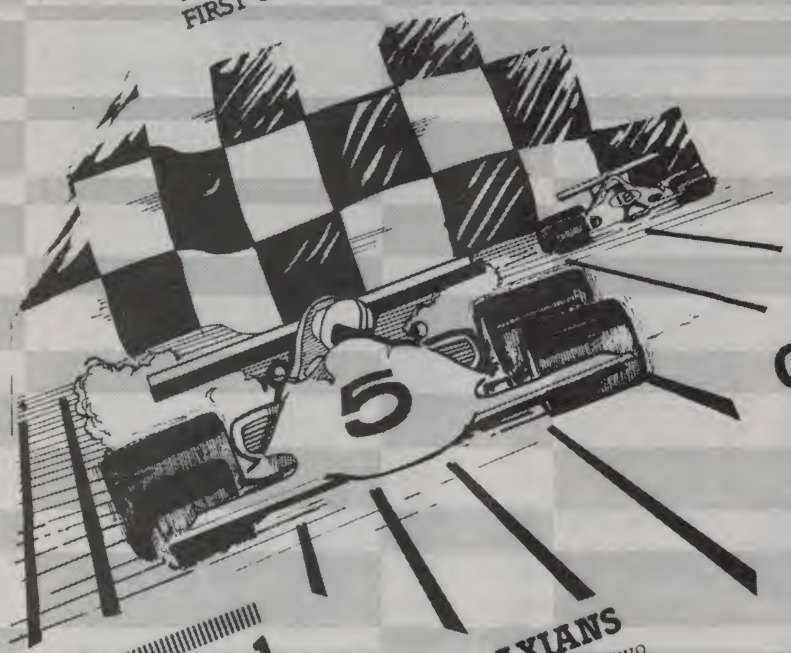

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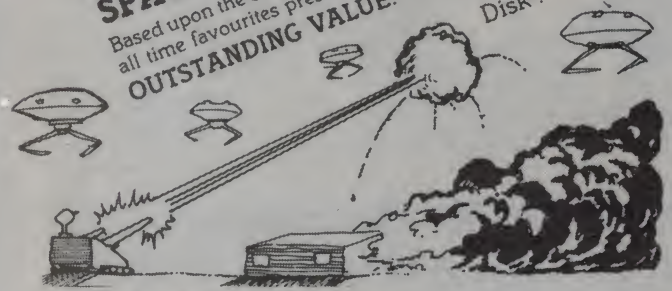

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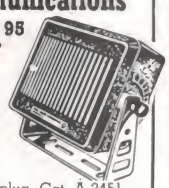

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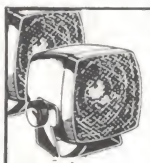

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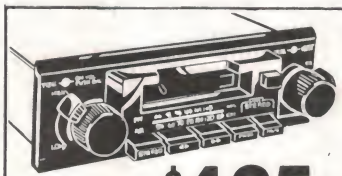

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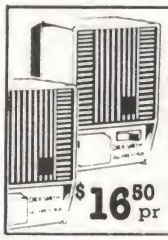

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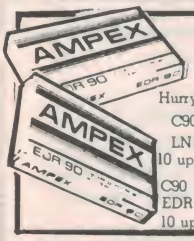

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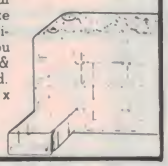

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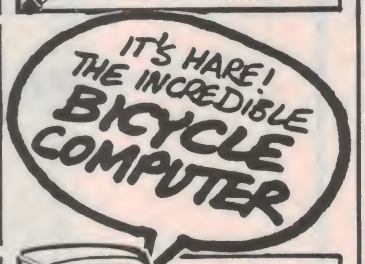

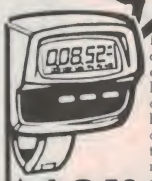

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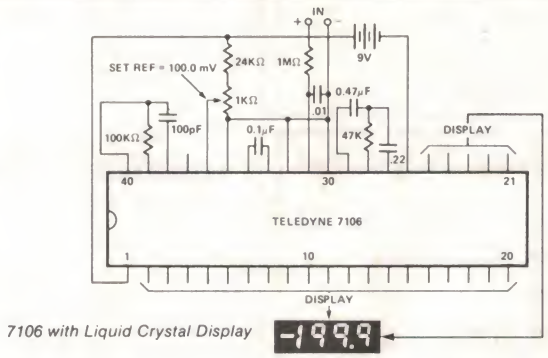

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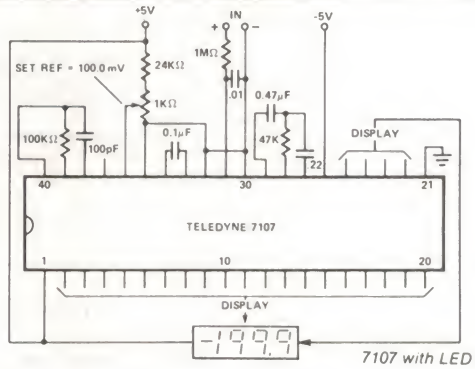

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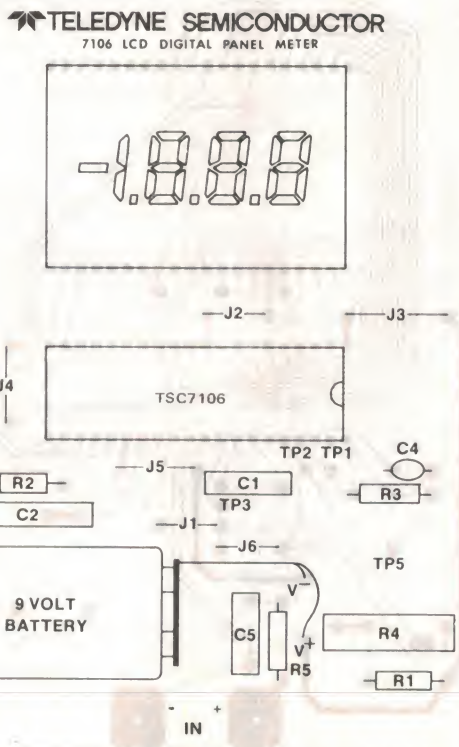

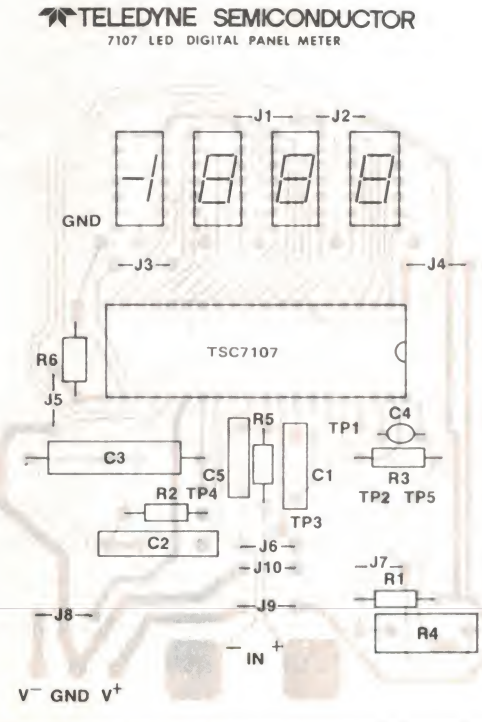

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More functions for the VZ200

This article details how you can simply add automatic line numbering and TRON and TROFF trace functions to the Dick Smith VZ200 colour computer.

Steve Olney

HERE is a simple way to add *automatic line numbering* and *trace* functions to VZ200 BASIC. Automatic !ine numbering should be self-explanatory. However, the trace function may need some explanation. When attempting to debug a BASIC program, it is sometimes useful to see exactly what sequence of instructions the computer is interpreting. This is the function of the trace command. It prints out on the video the sequence of line numbers the computer (the interpreter) is stepping through when executing a program. This allows you to make sure the program is doing what you intended it to do. (Especially useful in the case of conditional GOTO's or GOSUB's).

As adding the trace functions (TRON and TROFF) is the simplest task, I will deal with that first.

Before running your program, type in POKE 31003,175 from the immediate mode (no line numbers *That's it!* This is equivalent to typing in 'TRON'. Now when you run your program, each time a new line is selected to be interpreted (or the same line number repeated) it will be printed on the video. To disable this function just type POKE 31003,0 from the command level. This simulates using the 'TROFF' command.

A drawback with this method is that you might only want to debug a small section of the program and so have to contend with sorting out that small section from the rest of the displayed line numbers. This can be simply overcome by adding POKE 31003,175 into your program with a line number which places it in the program just before where you want to start the trace. Then add POKE 31003,0 with a line number which places it where you want the trace to stop.

Auto

Now to deal with the slightly more complex 'AUTO' function. This function, when enabled, saves you the trouble of typing sequential line numbers when entering a program. This very useful function will automatically display the next line number when you hit 'RETURN' at the end of a line of program.

To do this you need to supply the starting line number and the increment between lines. Next you need to set a flag which tells the BASIC that the 'AUTO' function is enabled. (This must be done last or you will go into the 'AUTO' mode before you have supplied the starting line and increment.)

The starting line number must be POKEd into locations 30946 and 30947, and the line increment POKEd into locations 30948 and 30949. These have to be in two-byte form with the least significant bit (LSB) going into the first location of each pair, and the most significant bit (MSB) going into the second.

For the line increment this is no problem as long as you keep the increment below 255. (Most increments would normally be less than 100). Just POKE 30948, 'increment' and then POKE 30949,0 where 'increment' is less than, or equal to 255. (I usually use 10 or 20 as the inerement.)

Of course, the line number would most likely be above 255, so you must convert your starting line number into two bytes where:

LINE NO. = (MSB * 256) + LSB

and where we:

POKE 30946, LSB and POKE 30947, MSB

Example: For a starting line number of 2000

MSB = INT(2000/256) = 7

LSB = LINE NO.—(MSB*256) = 208

So we must:

POKE 30946, 208

POKE 30947, 7

For those not content with trouble of calculating this every time the 'AUTO' mode is entered, I have written a short program to do this as well as to enable the 'AUTO' function itself. (Can be done directly by POKE 30934,175.) Use line numbers which will put it well out of the way of any main program you are entering.

```
 0 CLS
 10 INPUT"STARTING LINE NO. ";S
 20 INPUT"INCREMENT ";I
 30 MS=INT(S/256): LS=S-MS*256
 40 POKE 30946,LS: POKE 30947,MS
 50 MI=INT(I/256): LI=I-MI*256
 60 POKE 30948,LI: POKE 30949,MI
 70 POKE 30945,175
 80 END
```

For convenience, type this small program in starting from line number 0. This will enable quick access by just typing 'RUN' and then 'RETURN'. However to run your program, you will now need to type, 'RUN xxxx;, where 'xxxx' is the first line number of your program.

To exit from the 'AUTO' mode, type 'CTRL' and 'BREAK' simultaneously exactly the same way you exit or interrupt a BASIC program. Incidentally, BASIC will automatically exit from the 'AUTO' mode when the new line number would have been greater than 65529. (The maximum line number allowed in this BASIC.)

A useful feature of this 'AUTO' function is that, if you specify line numbers which include previously entered lines, then not only is the line number displayed but also the statements previously entered.

The cursor is conveniently positioned at the end of the line ready for any additions to that line. This can be used as a convenient editing feature. For example, let us suppose you have entered your program and now wish to go through and make corrections. Enter the first line number of the program to be corrected and the appropriate line increment for that program. You can now single step through your listing and make corrections as you wish! Unfortunately, there is no simple way of decrementing the line number. (other than manually POKEing in location 30946).

Why So Simple?

How was I able to add these two functions so easily? Well, on close scrutiny of the VZ200 BASIC in ROM, I discovered that it was fundamentally similar to Level II TRS-80 BASIC. By finding the equivalent control areas in RAM for the VZ200 BASIC, and by experimentation, I was able to get the functions working.

Apparently, the machine code for the execution of the 'AUTO', 'TRON' and 'TROFF' functions is still present in the VZ200 BASIC ROM, but the interpreter has been altered so as not to recognise the commands as valid in an input text string.

Why the machine code would be present in the BASIC ROM but not enabled is a bit strange. Perhaps some functions were dropped in order to implement all functions provided on the multi-function keys.

A word of warning! Like all situations where you are patching software (especially when written by someone else), beware of yet-undiscovered gremlins. I take no responsibility for any havoc wreaked by same!

A more elegant and flexible approach would be to intercept the text interpreter and make it recognise the 'AUTO' and trace commands from the immediate command level, and perhaps add a line renumbering command. But that's another story! ●

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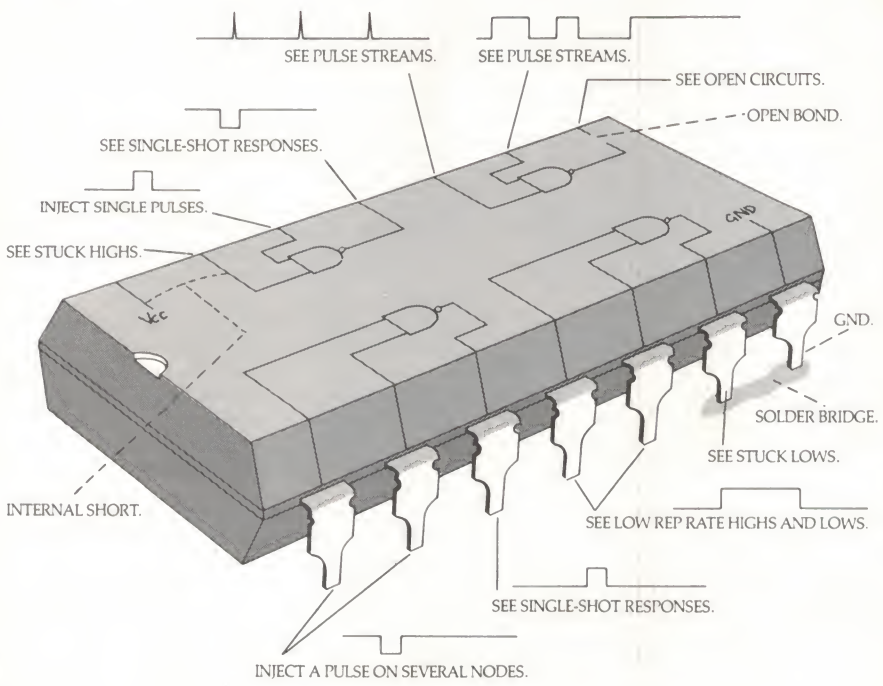

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ATOM

Miroslav Kostecki, Elizabeth Park SA.

Atom is a HI RES moving model of electrons orbiting an atom. The model is not meant to be accurate but shows a way of moving objects quickly along complex paths.

A path is first calculated and stored in an array. Then a loop is used to move along the stored points, thus the path is only calculated once before the movement. This greatly speeds the movement since calculation time is removed.

This method can be used where calculation time slows moving objects on a predictable path. Spinning shapes, bouncing balls and many physical simulations can easily use this method to speed up the graphics. The 'Atom' program may be changed to a model of the solar system.

ATOM

```
00120 SD4: DIM C(72),D(72),I(80),J(80): HIRES
00130 E=256: F=128: A1=0: A2=0
00140 PLOT E+1,F+1 TO E-1,F+1 TO E-1,F TO E+1,F
00150 FOR A=1 TO 64: REM # Calculate & store paths #
00160 A1=A1+.1964: E1=COS(A1): F1=SIN(A1)
00170 X=INT(27*(E1+F1/2))+E: Y=INT(20*(E1/2+F1))+F
00180 C(A)=X: D(A)=Y: SET X,Y: SETH X,Y
00190 A2=A2-.09818: E1=COS(A2): F1=SIN(A2)
00200 X=INT(68*(E1+F1/3))+E: Y=INT(50*(E1/3+F1))+F
00210 I(A)=X: J(A)=Y: SET X,Y: SETH X,Y
00220 NEXT A
00230 FOR A=1 TO 8: C(A+64)=C(A):D(A+64)=D(A):NEXT A
00240 FOR A=1 TO 16:I(A+64)=I(A):J(A+64)=J(A):NEXT A
00250 FOR A=1 TO 64: REM # Main loop for moving #
00260 RESET R+1,S: RESET R,S
00270 R=C(A): S=D(A): SET R,S: SET R+1,S
00280 RESETH G+1,H: RESETH G,H
00290 G=C(A+8): H=D(A+8): SETH G,H: SETH G+1,H
00300 RESET L+1,M: RESET L,M
00310 L=I(A): M=J(A): SET L,M: SET L+1,M
00320 RESETH P+1,Q: RESETH P,Q
00330 P=I(A+16): Q=J(A+16): SETH P,Q: SETH P+1,Q
00340 NEXT A: GOTO 250
```

VOLUME CONTROL

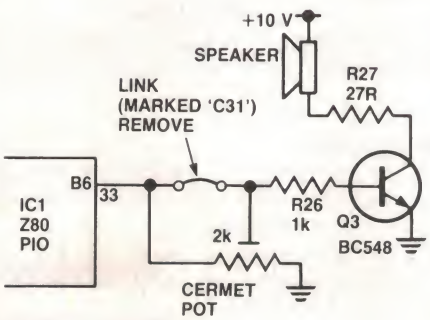
Graham Taylor, Fitzroy Victoria.

When playing with the sound possibilities of the Microbee late at night I received a certain amount of abuse. I thought that a volume control would be useful and, after studying the circuit diagram, I came up with this idea.

A cermet trimpot can be mounted just below and to the right of the 'RESET' key where there is a convenient hole in the keyboard's baseplate. Mount the trimpot on a small piece of veroboard and glue it over the hole, then drill a hole of appropriate diameter in the case to allow access.

A cermet trimpot is recommended as it is the ideal height and of sufficient ruggedness to work well. I just happened to have a 2k version but I imagine that any value between 1k and 20k will work.

The circuit diagram for my Microbee, which is now more than one year old, shows a capacitor (10 μF) in series with the speaker drive transistor's base resistor. However, there is a link in the corresponding place on the pc board so a track may have to be cut on later models.



Remove this link (see diagram) and attach wires from the trimpot to the appropriate places on the pc board. Now I can play 'Asteroids' and other noisy games without incurring the wrath of half the neighbourhood.

A toothpaste tube cap can be used as a knob, however, an appropriately sized screwdriver works better as the trimpot is flush with the top of the case and so it out of the way of the keys.

Another useful idea, when writing machine code sound routines, is to output 042H to port 2 as this will send the noise to the cassette port as well.

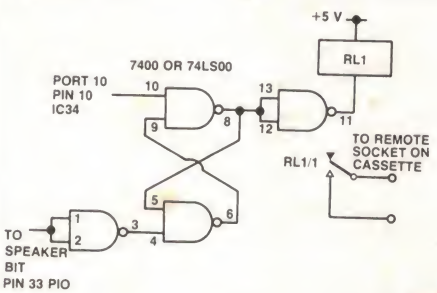
AUTOMATIC CASSETTE CONTROL

Tony Clay, Logon Qld

This modification uses only one IC and relay and allows automatic control of the cassette player during SAVEs and LOADs.

To save, type OUT 10,0:SAVE "TEST". The cassette turns on, the program is saved and the beep from the speaker (which occurs after both SAVE and LOAD) turns the motor off.

The relay resistance should be greater than 100 ohms.



A CAPITAL IDEA

Lindsay Ford, Dreamcards Victoria

As a software publishing firm, we get heaps of good software sent to us for evaluation. But one failing that occurs in about 50% of submitted programs is that programmers persist in using "POKE 257,1" to force the Microbee into only allowing input in upper case (i.e: in CAPITALS).

This is bad technique as it does not eliminate lower case, but simply reverses the operation of the shift lock key, causing all sorts of errors and crashes.

If you're writing software to a commercial (i.e: infallible) standard, then the *only* acceptable way to input a string (say A0$) in upper case exclusively is with this subroutine.

```
00100 REM Subroutine to INPUT string A0$ in mixed cases, then
00110 REM convert it to entirely upper case. Uses variables
00120 REM A0$, X and Y - by Dreamcards 1983 (Not copyright)
00130 INPUT A0$;: IF A0$="" THEN 130
00140 FOR X=1 TO LEN(A0$): Y=ASC(A0$(;X)): IF Y>96 THEN LET
      A0$ = A0$(;1, X-1) + CHR(Y-32) + A0$(;X+1)
00150 NEXT X: RETURN
```

A PREDITOR/PREY SIMULATION

J. Murfet, Hadspen Tasmania

The original program 'Prey', a preditor/prey simulation for the Apple II, was written by Phil Cohen and was published in ETI, September 1982.

The program has now been modified for the Microbee. One drawback is that when fed with erratic changes in variables, the 'Bee sometimes runs out of PCGs.

A PREDITOR/PREY SIMULATION

```
00130   CLS
00140   A1 = 500:C1 = 130: B1= 85: D1 = 15
00150   PLAY 16;16; 20; 23; 0;20;23,8
00160   F1 = 10: G1 = 20:H1 = 1
00170   PRINT " THIS IS A PROGRAM TO  SIMULATE THE EFFECT
        ON THE POPULATION"
00180   PRINT " OF TWO SPECIES BY ENVIRONMENTAL CHANGES
        (CULLING BY HUMANS,"
00190   PRINT "FOOD LOSS BY DROUGHT, DISEASE, ETC)."
00200   CURS 15, 12: PRINT " PRESS RETURN TO BEGIN PROGRAM"
00210   A5$ = KEY $: if A5$ = "" THEN 210
00220   CLS
00230   PRINT " 1 SIZE OF TERRITORY"; TAB (40); A1
00240   PRINT
00250   PRINT " 2 PREY POPULATION"; TAB (40); C1
00260   PRINT
00270   PRINT " 3 PREDITOR POPULATION"; TAB (40); B1
00280   PRINT
00290   PRINT " 4 FOOD YIELD PER UNIT AREA"; TAB (40); D1
00300   PRINT
00310   PRINT " 5 PREY NATURAL LIFE SPAN"; TAB (40); F1
00320   PRINT
00330   PRINT " 6 PREDITOR NATURAL LIFE SPAN"; TAB (40);G1
00340   PRINT
00350   PRINT " 7 PREY CULL LOSSES"; TAB (40); H1
00360   INPUT " WHICH WOULD YOU LIKE TO ALTER (9 = FINISHED)
        ?"; T1
00370   ON INT (T1) GOTO 390, 400, 410, 420, 430, 440, 450,
        220, 460
00380   PRINT
00390   INPUT " TERRITORY SIZE?";A1: GOTO 220
00400   INPUT " PREY POPULATION? ";C1: GOTO 220
00410   INPUT "PREDITOR PULULATION? ";B1: GOTO 220
00420   INPUT " FOOD YIELD PER UNIT AREA?";D1: GOTO 220
00430   INPUT " PREY NATURAL LIFE SPAN?"; F1: GOTO 220
00440   INPUT " PREDITOR NATURAL LIFE SPAN? "; G1: GOTO 220
00450   INPUT "PREY CULL LOSSES?";H1:GOTO 220
00460   INPUT " YEAR FOR CHANGE (0 - 10)?";E
00470   J = (49 * E ) + 10
00480   INPUT "WHICH VARIABLE TO CHANGE (1 - 7 ) ? " ; L
00490   IF L > 7 OR L < 1 THEN 520
00500   PRINT " VALUE TO BE SET AT YEAR ";E;
00510   INPUT K1
00520   U1 = 10: CLS: HIRES
00530   REM *** PUT BASE LINE ON SCREEN ***
00540   FOR I = 1 TO 10
00550   PLOT INT(U1), 0 TO INT (U1) + 49, 0 TO INT (U1) + 49, 4
00560   U1 = U1 + 49
00570   NEXT I
00580   X1 = 11
00590   P1 = (C1 * B1) /A1
00600   A3 = A1 * D1
00610   If C1 = 0 THEN LET M1 = 0: GOTO 630
00620   M1 = A3/ C1
00630   IF M1 > C1/4 THEN LET M1=C1/4
00640   N1 = 10 * P1/B1
00650   IF N1> B1/4 THEN LET N1 = B1/4
00660   Q1 = (C1-M1)/F1
00670   R1 = (B1-M1)/G1
00680   C1 = C1 - Q1 - P1 - M1 - H1
00690   B1 = B1 - R1 + N1
00700   IF C1 < 0 THEN LET C1 = 0
00710   IF B1 < 0 THEN LET B1 = 0
00720   Y1 = (. 8 * C1)
00730   IF Y1 < 1 THEN LET Y1 = 1
00740   IF Y1 > 200 THEN LET Y1 = 200
00750   IF X1 = 10 THEN 760: IF X1 < 10 THEN LET X1 = 10
00760   SET INT (X1), INT (Y1)
00770   Y1 = (. 5 * B1)
00780   IF Y1 > 1 AND Y1 < 250 AND X1/3 = X1/3 THEN PLOT INT (X1),
        INT (Y1)-1 TO INT (X1), INT (Y1) + 2
00790   X1 = X1 + 2
00800   IF INT (X1) < J  OR INT (X1) > J + 1 THEN 910
00810   PRINT " YEAR" ;E; "";
00820   ON L GOTO 830, 840, 850, 860, 870, 880, 890
00830   PRINT " TERR " ;A1;:A1 = K1: GOTO 900
00840   PRINT " PREY " ; INT (C1);: C1 = K1: GOTO 900
00850   PRINT " PRED " ; INT (B1);: B1 = K1: GOTO 900
00860   PRINT " YIELD " ;D1;:D1 = K1: GOTO 900
00870   PRINT " PREY SPAN " ; F1;: F1 = K1: GOTO 900
00880   PRINT " PRED SPAN " ;G1;: G1 = K1: GOTO 900
00890   PRINT " CULL " ; H1;: H1 = K1
00900   PRINT " ->  ";K1; "";
00910   IF X1 < 490 THEN 590
00920   INPUT "";A2$
00930   GOTO 220
```

START AND STOP KEY

P. J. Bisset, Benowa Qld.

A useful keyboard addition would be a RUN/STOP key to start program execution and halt single key operations. This program simply allows the ESC key to be used to run and halt BASIC programs.

It is based on a program written by D. J. Whyatt for the Microbee and published in ETI, December 1983 on page 57.

The routine checks the keyboard input and if ESC is pressed then control is passed to ESCKEY. Pressing any key will automatically start the BASIC program currently in memory.

When a program is running ESC will also halt the program temporarily.

Once the BASIC listing has been entered it can be deleted and the ESC key used to start and stop BASIC programs that are subsequently entered.

SOURCE LISTING

```
LINE    LABEL   MNEM    OPERAND
00100           ORG     3A98H
00110           CALL    0A3E9H
00120           PUSH    AF
00130           CP      1BH
00140           JR      Z,ESCKEY ;If ESC pressed then jump
00150           POP     AF
00160           RET
00170 ESCKEY    POP     AF
00180           CALL    8006H    ;Wait for key to be pressed.
00190           CP      1BH
00200           RET     Z   ;If ESC pressed then leave routine
00210           JP      801EH ;otherwise start BASIC program.
```

BASIC LISTING

```
00100 FOR I=15000 TO 15019:READ D:POKE I,D:NEXT I
00110 POKE 194,152:POKE 195,58
00120 DATA 205,233,163,245,254,27,40,2,241,201
00130 DATA 241,205,6,128,254,27,200,195,30,128
```

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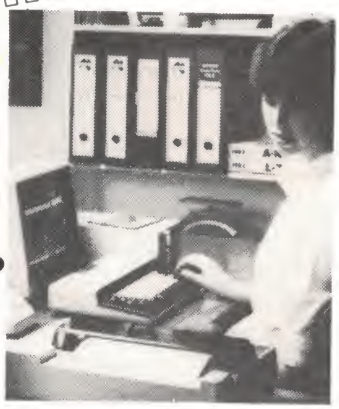

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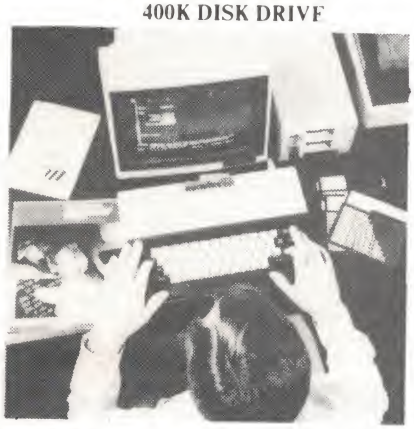

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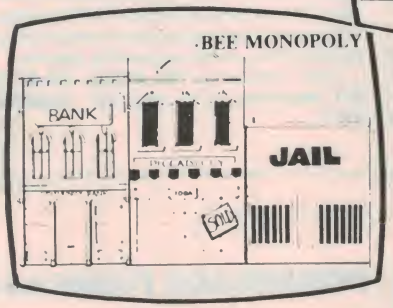

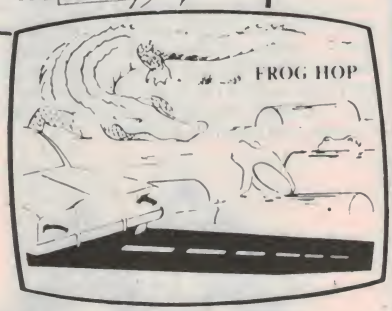

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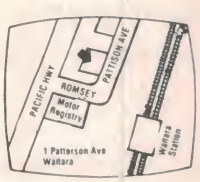

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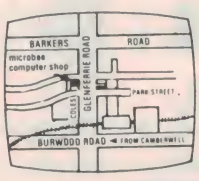
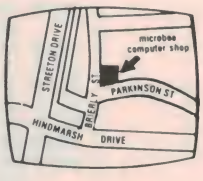
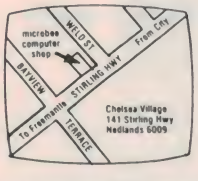


729 Glenferrie Rd,
Hawthorn 3122.
Phone (03) 819 5288



Cooleman Court,
Weston A.C.T. 2611.
Phone (062) 88 6384



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Comput-Ed, 8 Park Arcade, Park Avenue, Coffs Harbour.

ACT: **Computech,** Belconnen Churches Centre, Benjamin Way, Belconnen.

VIC: **Computerland South Melbourne,** 37 Albert Road, Melbourne.

S.A.: **Key Computers,** 1061 South Road, Edwardstown. 77 Grenfell Street, Adelaide.

QLD: **Software 80,** 105 Milton Road, Milton.

Electrographic Office Systems, 25 Grafton Street, Cairns.

Town and Country Computers, CTL Centre, Anne Street, Aitkenvale, Townsville.

TAS: **Central Data,** 14A Goodwin Street, Launceston.

✶ENCOURAGEMENT✶

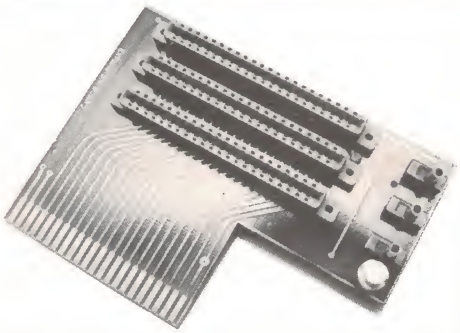
Ozi-Soft, in conjunction with Computer Technics, is offering to donate a VIC-20 expansion board for the best software item submitted to this column every month.

The board is Australian-designed and manufactured and simply plugs into the VIC-20's expansion slot. It features three sockets that can be independently switch-selected, plus an on-board reset switch. With it you can plug in up to three separate expansion units to your VIC-20 and avoid the hassle of plugging things in and out and turning the computer on and off each time.

It is distributed by **Computer Technics, 123 Clarence Street, Sydney (G.P.O. Box 4936) NSW 2000. (02)29-7244.** The board costs $59.95.

All submissions must be accompanied by a signed letter from you stating that it's your original work. The winning submission will be judged by the Editor and no correspondence will be entered into. All published submissions will be paid for.

Send entries to: **The Editor, VIC-20 Column, ETI Magazine, P.O. Box 227, Waterloo NSW 2017.**



HORSERACE FORECAST

Matt Underwood, Box Hill North, Vic.

If you like to have a bet on the horses then this program may help you to make some money. However, the predictions of this program as to which horse will run first, second, etc, may not be accurate as there are many factors which affect the result. But with a bit of common sense the punter should show a profit over a number of races.

I tried this program for the Caulfield and Melbourne Cup and I found it very helpful. It picked three of the first five place getters in the Caulfield and the winner of the Melbourne Cup, so I am showing a profit so far.

The program gives the option of having a printout made of the results. Some lines may exceed the allowable 88 characters so some words may have to be abbreviated.

Most of the data needed to feed into this program may be found in any newspaper which has a turf or form guide of the races.

HORSERACE FORECAST

```
READY.

10 PRINT"□":POKE36879,26
20 DIMHN$(50),VA(50)
30 GOSUB1000
40 CO=1:OC=CO:PRINT"□":POKE36879,29
50 PRINT"ENTER TRACK CONDITIONS"
60 PRINT"1=HEAVY":PRINT"2=SOFT":PRINT"3=SOFT-GOOD":PRINT"
   4=GOOD":PRINT"5=GOOD-FIRM":PRINT"6=FIRM":PRINT"7=HEAVY"
70 INPUTCG:CG=INT(CG)
80 IFCG<1ORCG>7THEN50
90 PRINT"□"
100 PRINT"ENTER NAME OF RUNNER";CO:INPUTHN$(CO)
110 PRINT"ENTER POSITION IN ODDS":INPUT OP
120 PRINT"□■NOW ENTER■":FC=0
130 PRINT"ENTER BARRIER NUMBER":INPUTPR
140 IFOC=CGANDPR=1THENFC=FC+2
150 IFOC=CGANDPR<4THENFC=FC+1
160 IFOC=CGANDPR>8THENFC=FC-2
170 IFOC=CGTHENFC=FC-1
180 IFPR=1THENFC=FC+1
190 FC=FC-1
200 IF FC>10THENFC=10ORIF FC<-10THENFC=-10
210 PRINT" PLACING IN LAST RACE RUN":INPUTP1
220 PRINT"PLACING IN SECOND LAST RACE":INPUTP2
230 PRINT"PLACING IN THIRD LAST RACE":INPUTP3
240 PRINT"PLACING IN FOURTH LAST RACE":INPUTP4
250 PRINT"ENTER CLASS OF JOCKEY (1-4)":INPUTJC
260 PRINT"ENTER ZERO IF WEIGHT  CARRIED OR TEN IF NOT":
    INPUTWE
270 PRINT"ENTER NO.OF TIPS GIVEN":INPUTTP
280 IFP1=0THEN300
290 P1=12/P1
300 IFP2=0THEN320
310 P2=12/P2
320 IFP3=0THEN340
330 P3=6/P3
340 IFP4=0THEN360
350 P4=6/P4
360 OP=OP+3
370 OP=60/OP
380 JC=12/JC
390 TP=TP/2
400 OT=P1+P2+P3+P4+OP+FC+JC+WE+TP
410 VA(CO)=OT
420 PRINT"□"
430 PRINTHN$(CO);" HAS BEEN ASSIGNED THE RATING OF";VA(CO)
435 PRINT
440 PRINT"ANY MORE HORSES (Y/N)":INPUTAA$
450 IFAA$="Y"THENCO=CO+1:GOTO90
460 OT=0:FORX=1TOCO:OT=OT+VA(X):NEXT
465 PRINT
470 PRINT"PRINTOUT YES/NO":INPUTP$
480 PRINT"□"
490 IFP$<>"YES"THEN520
494 PRINT"□■■■
```

Peter Skilton of Seaford Vic. is the winner of the VIC-20 expansion board this month. His useful program, Curve Fitter, gives the line-of-best-fit to graphical data.

CURVE FITTER

Peter Skilton, Seaford, Vic.

This program proves that the VIC-20 can do more than just play video games. It gives you the line-of-best-fit to graphical data, the procedure being to obtain the gradient and intercept of the line. In this simple case we are adjusting two parameters (m and c, if y=mx+c).

This program is a general routine for fitting *any* (x,y) data for *any* mathematical function with *any* number of adjustable parameters. The theory from which this algorithm comes can be found in most advanced books on non-linear least-squares techniques i.e: *Data Reduction and Error Analysis for the Physical Sciences* by P. R. Bevington.

A general subroutine at line 740 is provided to find the inverse matrix of the PxP matrix A1. This will work for *any* square matrix of *any* size and so could be used in many other programs. The inverse is returned in the PxP array E.

The listing shown fits a cubic equation with its four adjustable parameters. Pictorially, this is done by searching five-dimensional parameter hyperspace (with a program pointer of length equal to lambda) for the minimum of the well that is present. The parameter values corresponding to the bottom of the well are those of the curve-of-best-fit. By the nature of the cubic power series, if your data is more accurately represented by a parabola or line, then the higher order parameters will approach zero as required.

When the program is running it just fits into the unexpanded VIC and can handle up to 34 input data points. Of course, more can be input with a memory expansion cartridge and by redimensioning the array Y in line 70.

Intermediate calculations are displayed on the screen during execution. The time between these iterations will increase with the number of data points.

The criterion for convergence of the fit is that the smallest value of chi-square is obtained. This variable is related to the deviation of your data from the calculated curve-of-best-fit. So the closer chi-square is to zero, the better the fitted equation matches your data. The final results give the parameters followed by their respective standard deviation in brackets.

A sample printout is shown using the temperature dependence of resistance for a thermistor. The calculated curve-of-best-fit is drawn on the graph. I strongly recommend that you try these data once you have typed in the program as any bug may distort the apparent parameter values obtained.

This is an entirely general routine which can be used to fit any mathematical function. If you wish to change the equation fitted then seven lines need to be altered.

At line 60 set P equal to the number of adjustable parameters in the function and let F$ be whatever equation you are fitting. In line 80 set P$ to be all the adjustable parameters (each must be two characters long) exactly as you gave them in F$.

In 630 you must give P expressions of the form Qn=P(n). In 640 is the value of the function at X. Q1, Q2, Q3, etc, correspond to the parameters in the order you gave them in P$, so write 640 in the form F0= (right-hand side of F$) except using Q1, Q2, Q3, etc, in the expression for F$ instead of the nomenclature you chose in P$.

In line 650 are the partial derivatives of line 640 with respect to each parameter Qn. Thus the partial derivative of, say, F0=Q1*EXP(Q2*X) with respect to Q1 would be D(1)=EXP(Q2*X) and with respect to Q2 would be D(2)=Q1*X*EXP(Q2*X).

Line 680 is identical to 630 except for using the array P1 instead of P. Line 700 is simply T=Y(J,2) which is the expression given in the right-hand side of line 640.

If you are unfortunate enough to get an error message (assuming no typing mistakes), then probably your initial guesses were grossly wrong i.e: several orders of magnitude out, or else your derivative expressions in 650 are incorrect.

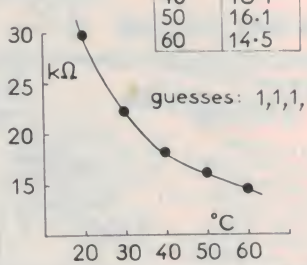
Remember that the number of data must exceed the number of adjustable parameters by at least one to define chi-square and unambiguously give the curve-of-best-fit.

CURVE FITTER

```
10 POKE36879,110:PRINT"■=■■■■■CURVE FITTER■■"
20 PRINT"■■DATA FITTING PROGRAM■■FOR ANY DIFFERENTIABLE
   ■■■■■■■■FUNCTION"
30 PRINT"■■■DATA MUST BE ENTERED■■■■■AS (X,Y) VALUES■■■"
40 REM P.F.SKILTON 1/2/83
60 P=4:F$="Y=A0+A1.X+A2.X*X+A3.X*X*X"
70 DIMA(P,P),A1(P,P),D(P),E(P,P),P(P),P1(P),S(P),X(P,1),
   Y(35,2),P$(P*2)
80 P$="A0A1A2A3"
90 DATA0.0001,0.001,100,1:REM PERFORM A NON-LINEAR LEAST-
   SQUARES FIT
100 READE1,L1,N,W0:GOSUB460:PRINT"■■■■■■■■■■■■";F$:PRINT"■■
   PARAMETER GUESSES■■■ ■"
110 FORI=1TOP:PRINT"■":PRINTMID$(P$,2*I-1,2)" = ";:INPUTP(I):
   GOSUB500:NEXT
120 FORI=1TOP:P1(I)=P(I):X(I,1)=0:FORJ=1TOP:A(I,J)=0:NEXT:
   NEXT
160 FORY=1TOI1:GOSUB620:FORJ=1TOP:X(J,1)=X(J,1)+W0*(Y(Y,2)
   -F0)*D(J)
200 FORK=1TOJ:A(J,K)=A(J,K)+W0*D(J)*D(K):NEXT:NEXT:NEXT
230 FORJ=1TOP:FORK=1TOJ:A(K,J)=A(J,K):NEXT:NEXT:
   IFN0=0THENGOSUB670:GOSUB540
250 S0=S
260 FORK=1TOP:FORL=1TOP:A1(K,L)=A(K,L)/SQR(A(K,K)*A(L,L))
   :NEXT:A1(K,K)=1+L1:NEXT
300 GOSUB740:FORJ=1TOP:P1(J)=P(J)
330 FORK=1TOP:P1(J)=P1(J)+X(K,1)*E(J,K)/SQR(A(J,J)*A(K,K))
   :NEXT:NEXT
350 GOSUB670:IFS<=(1+E1)*S0THENGOTO380
360 L1=L1*10:IFL1>1E+10THENPRINT"MAX. LAMBDA EXCEEDED":STOP
370 GOTO260
380 N0=N0+1
390 FORJ=1TOP:P(J)=P1(J):S(J)=SQR(E(J,J)/A(J,J))*SQR(S)
   :NEXT:GOSUB540
410 IF(S0-S)/S0<=E1THEN440
420 IFN0>NTHENPRINT"MAX.ITERATIONS REACHED":STOP
430 L1=L1/10:GOTO120
440 PRINT"■■FINAL RESULTS":PRINT F$"■■":Q=1:GOTO550
460 I=1:PRINT"■■■■ENTER DATA.....■■■■■FINISH BY TYPING 999■"
470 PRINT"X(";I;") = ";:INPUTY(I,1):IFY(I,1)=999THENI1=I-1:
   GOTO510
490 PRINT"■Y(";I;") = ";:INPUTY(I,2):GOSUB500:I=I+1:GOTO470
500 FORJ=8032TO8185:POKEJ,32:NEXT:PRINT"TTT":RETURN
510 INPUT"■ANY CHANGES TO DATA";Y$:IFY$="N"THENRETURN
520 GOSUB500:PRINT"    DATUM NO. = ";:INPUTI:GOSUB500:PRINT"
   ■X(";I;:INPUT") = ";Y(I,1)
530 PRINT"■Y(";I;:INPUT") = ";Y(I,2):GOSUB500:GOTO510
540 PRINT"■"
550 FORI=1TOP:PRINTMID$(P$,2*I-1,2)" "P(I):PRINT" ("S(I)")"
   :PRINT:NEXT
590 PRINT"ITERTN:"N0" DATA:"I1:PRINT"LAMBDA:"L1:PRINT"
   CHISQR:"S
600 IFQ=1THENPOKE36879,13:END
610 RETURN
620 REM FUNCTION AND PARTIAL DERIVATIVES SUBROUTINE
630 Q1=P(1):Q2=P(2):Q3=P(3):Q4=P(4)
635 X=Y(Y,1)
640 F0=Q1+Q2*X+Q3*X*X+Q4*X*X*X
650 D(1)=1:D(2)=X:D(3)=X*X:D(4)=X*X*X
660 RETURN
670 REM CHISQR SUBROUTINE
680 Q1=P1(1):Q2=P1(2):Q3=P1(3):Q4=P1(4)
690 S=0:FORJ=1TOI1:X=Y(J,1)
700 T=Y(J,2)-Q1-Q2*X-Q3*X*X-Q4*X*X*X
710 S=S+T*T*W0:NEXT:S=S/(I1-P):RETURN
740 REM MATRIX INVERSION SUBROUTINE E=INV(A1)
750 FORI=1TOP:FORJ=1TOP:E(I,J)=A1(I,J):NEXT:NEXT:FORK=1TOP
   :FORJ=1TOP:IFJ=KTHEN80 ø
790 E(K,J)=E(K,J)/E(K,K)
800 NEXT:E(K,K)=1/E(K,K):FORI=1TOP:IFI=KTHEN880
840 FORJ=1TOP:IFJ=KTHEN870
860 E(I,J)=E(I,J)-E(K,J)*E(I,K)
870 NEXT
880 NEXT
890 FORI=1TOP:IFI=KTHEN920
910 E(I,K)=-E(I,K)*E(K,K)
920 NEXT:NEXT:RETURN
```

```
FINAL RESULTS
Y=A0+A1.X+A2.X*X+A3.X*X*X

A0   61.9399998
   ( .497089077 )

A1  -2.32488093
   ( .0428482083 )

A2   .041071428
   ( 1.13789603E-03 )

A3  -2.58333329E-04
   ( 9.44878522E-06 )

ITERTN: 7  DATA: 5
LAMBDA: 1E-09
CHISQR: 1.28571414E-03

READY
```

x[°C]	y[kΩ]
20	29·8
30	22·2
40	18·1
50	16·1
60	14·5



Knockout Bargains

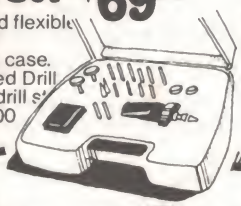
High Speed Drill

Precision drill with 3 interchangeable collettes for sizes from .1mm to 2.4mm. 10,500 RPM 9-16V. Ref 20,000

$16.50

Deluxe Drill Set $69.00

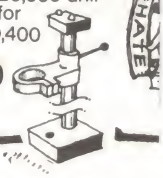
Includes Drill, stand and flexible drive complete with 30 accessories in carrying case. Includes the High Speed Drill shown above plus the drill stand shown below. Ref 20100



Drill Stand

Stand for Ref 20,000 drill (above). Ideal for PCBs Ref 20,400

$12.50



Save on SolderVac

Buy the best quality desoldering tool at the lowest price around. The incredible U.S. made Soldervac comes with teflon™ tip, powerful low inertia plunger and self lubricating trigger latch. Gets parts out of PCBs in seconds.

don't pay $12.50

only $8.50

Current/Polarity Checker

Incredibly versatile AC and DC checker works over the range 3.5V to 400V. Ingenious three LED system indicates AC (both lights), DC positive (plus light) DC negative (minus light). Use it in the home, the car and the workshop.

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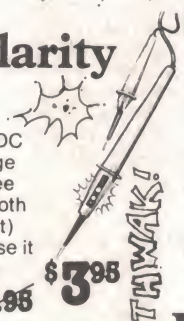
$3.95



Centronics Plugs at Knockout Prices

Our opposition are asking around $20.00 for these plugs Come to Sheridans for a Knockout deal!!

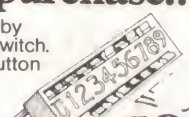
Amphenol type 57/303/60 solder spill type **$9.50**

Ribbon cable type **$9.70**

Jawbreaker purchase!!

Top quality English Made by SAE. 10 way .1" DIL DIP switch. Special top quality pushbutton type. At a punchup price!! $1.30 each 10+ **$1.20**

Less than 1/2 price



The Ultimate joystick for the VIC-20 and Atari

The incredible Pointmaster is truly the finest Joystick on the market and will add incredibly to your enjoyment of video computer games. Just look:

- High speed thumb trigger
- Unique hand grip (as on actual aircraft)
- Self centring
- Long 150cm cord.

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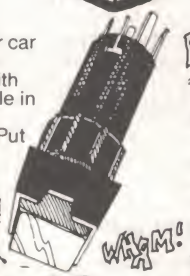
Illuminated Pushbutton

These superbly made IMO pushbuttons are perfect for car and other alarm situations. SPDT momentary action with 12V long life globe. Available in red, green or yellow lense. Others are asking $15.00. Put them in the losers corner!!

only $8.95



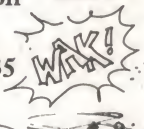
Hewlett Packard Opto

HDSP-5301 .56" Common Anode
Equivalent to FND507 (but better)
only $2.05 each, 10+ $1.85

HDSP5303 .56" Common Cathode
equivalent to FND500 (but better)
only $1.70 each, 10+ $1.55

HP 5082-7730 .3" common anode
equivalent to MAN71, DL707)
only $1.50 each, 10+ $1.35

HP 5082-7740 .3" common cathode
equivalent to MAN74, DL704 etc
only $1.50 each, 10+ $1.35



SPECTRUM ANALYSER TWINS FROM TEK.

Tektronix is adding a new set of 'twins' to its 490 series spectrum analyser family. The two major new products — the 494 and its programmable compatible counterpart, the 494P — offer many features never before available in a spectrum analyser, the company claims.

The new analysers cover the frequency range from 10 kHz to 325 GHz and offer an exclusive 'help' mode which provides explanations of controls and functions, on the CRT itself, at a push of a button.

The new 494/494P spectrum analysers are similar to the popular 492/492P (50 kHz to 220 GHz) and the 496/496P (1 kHz to 1.8 GHz) spectrum analysers in appearance, operation, and rugged environmental specifications.

The 494/494P possesses *the first three-year warranty* in the history of the spectrum analyser industry, Tektronix claims. The 494 and 494P offer frequency measurement accuracy typical of a counter; ±27 Hz at 21 GHz, a first for portable analyses the company say. Frequency coverage is extended to 325 GHz.

Another significant industry first, according to Tektronix, is the unique 'help' mode that gives the new user operational confidence by displaying control function descriptions with the touch of a button. When you press the help button instructions appear on the CRT. You can then press any pushbutton and a description of its function appears. The help text, plus all other screen messages, are in English with an optional second language of either German, French, of Spanish.

Ten on-board registers for pre-setting instrument control settings saves set-up time and improves measurement repeatability. Measurements made in the field are transported to the laboratory for comparison and analysis. Up to nine displays are stored with front panel control settings.

A data dump-to-plotter facility provides a plotter interface for hard copies without having to hook up a controller. It is compatible with both Tektronix and Hewlett-Packard GPIB plotters.

The 50-75 GHz, 75-110 GHz and 110-170 GHz bands have been included, plus new waveguide mixers for these bands and others that cover from 18 GHZ to 325 GHz.

The multiple line CRT readout displays up to 16 lines of 40 characters for expanded operator prompt messages when operating in programmable mode. For further details contact your local Tektronix office.

FLEXIBLE LIGHT

The FL-100 flexible light illuminates those hard-to-reach work areas, putting the light where you need it.

Its high-intensity prefocussed bulb and reflector system measures only ½" in diameter. The tool's 4" long flexible shaft positions light in any direction.

Additional features are a convenient rotary switch and a spring clip on the handle which allows it to be clipped to any handy surface, thereby freeing both hands. Ideal for checking and repairing electronic and mechanical equipment of all types, the FL-100 is essential for workshop and field service use, the company claims. It requires two "AA" batteries (not included).

The FL-100 is available from stock at local electronics distributors nationwide or directly from **OK Industries, 92 Chandos St, St Leonards NSW.**

LOW-COST FREQUENCY COUNTERS FROM H-P

Two new frequency counters from Hewlett-Packard, the HP 5384A and HP 5385A, offer new levels of accuracy and resolution in economy-priced systems counters covering the frequency range of 10 Hz to 1 GHz.

High input sensitivity coupled with extensive input-signal conditioning result in enhanced performance in R&D testing. Additionally, low-priced systems capability is available in either HP-IB (standard) or HP-IL (Hewlett-Packard Interface Loop), which is optional.

Frequency range for the HP 5384A is 10 Hz to 225 MHz. For the HP 5385A. it is 10 Hz to 1 GHz. Key specifications common to both units include: measurement resolution is nine digits per second minimum; four- to 11-digit display resolution is front-panel selectable to simplify readings; input sensitivity is a high 10 mV RMS (typical); and three gate time selections (0.1, 1.0 and 10 seconds) are provided.

Options enhance operation in the lab or the field. They are: HP-IL for low-priced bench or field automation, a battery pack for portable operation and an oven timebase for laboratory accuracy in the field. The remote display feature allows measurement displays in engineering units, such as RPM, % drift, IF, etc., as well as message and prompts, when the counters are used in conjunction with a handheld or desktop computer.

Contact your local H-P office for more details. Tell them "ETI sent me"!

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$50.00

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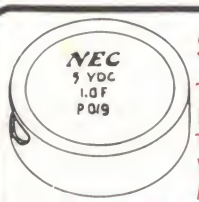
- One Speak & Spell learning aid
- The new E.T. Fantasy Module
- New photo-filled activity book
- Colorful movie poster
- T-shirt decal with E.T. and Elliot

SOFTWARE FOR THE "MICROBEE" FROM MYTEK

Basic Tutorial	$20.95
Composer Bee II	$20.95
Frogger	$18.50
Ghost Muncher & Kilopede	$23.16
King Kong	$20.95
Trsbee	$31.00
Machine Code Tutorial	$23.82
Meteor Rescue	$18.50
Mytex Monitor	$11.01
Logo–Bee	$23.49
Touch–Type Tutor	$20.95
Music B	$20.95
Tape Doctor	$18.45
Backgammon	$20.95
Beez 80	$20.95
Debug	$18.45
Emu Joust	$20.95
Chopper	$20.95
Asteroids Plus	$23.49
Defender	$23.49



SUPER CAP

THE NEW RELIABLE POWER SOURCE TO MAINTAIN VOLATILE MEMORY BANKS DURING AC POWER FAILURES

The high capacitance of one farad and low leakage current of this supercapacitor makes it an efficient, reliable and cost-effective storage device with the following advantages.

- It never needs replacing or maintenance.
- Unlike nicads it does not exhibit discharge memory.
- Lack of polarity enables it to be wired either way.
- It can be soldered onto P.C.B.s with other components.
- It can be charged at high and low current rates, i.e. microamps to amps.
- Completely safe. It will not explode under extremes of temperature, nor will it leak.

$14.95

PHILLIPS SPEAKERS SUPER SPECIALS

AD12650/W8 Slashed from $106.61 to $81.37
AD12250/W8 Slashed from $97.74 to $75.00

PHILLIPS AD12250/W8

8 OHM Rated Impedance
100 WATTS RMS
Frequency Range 40 to 1800 Hz
Recommended 80 litre sealed enclosure
Ceramic Magnet 1.15 kg

PHILLIPS AD12650/W8

8 OHM Rated Impedance
Max Power 60 WATTS RMS
Frequency Range 35 to 2000 Hz
Recommended 80 litre sealed enclosure
Ceramic Magnet 0.53 kg

TEXTOOL ZERO INSERTION FORCE SOCKETS

16 PIN	$10.83	28 PIN	$14.49
24 PIN	$10.06	40 PIN	$17.83

HILLS VHF/UHF DIPLEXER $15.14

CONNECTS INPUTS FROM VHF AND UHF ANTENNAS TOGETHER FOR IDEAL RECEPTION ON ALL CHANNELS.

MAGRATHS SUPER SPECIALS

SEMICONDUCTORS

4000 Series

4001	.35	4511	1.05	7426	.46	74LS12	.44	74LS163	.81	6821	2.88
4002	.35	4514	2.60	7430	.46	74LS13	.44	74LS164	.81	68A21	4.03
4006	.93	4516	1.10	7432	.46	74LS14	.44	74LS165	1.38	6834	15.30
4007	.40	4518	.96	7440	.46	74LS15	.44	74LS168	1.63	6852	6.30
4009	.69	4520	.96	7441	1.07	74LS20	.44	74LS169	1.63	6850	5.96
4010	.62	4528	1.27	7442	.46	74LS21	.44	74LS170	1.04	68B50	11.50
4011	.33	4543	1.63	7445	.98	74LS22	.44	74LS173	.75	6854	16.10
4012	.44	4702	10.29	7446	.98	74LS26	.44	74LS174	.69	2516	4.27
4013	.48	4723	1.74	7447	.75	74LS27	.44	74LS175	.69	2532	8.05
4014	1.15	4724	2.23	7448	1.44	74LS30	.44	74LS189	6.13	2564	13.80
4015	.96	4556	1.84	7460	.46	74LS32	.44	74LS190	1.04	2732	6.33
4016	.51			7473	.46	74LS37	.44	74LS191	1.04	2764	9.38
4017	.96	**74C Series**		7474	.46	74LS38	.44	74LS192	.75	27128	44.85
4018	1.01	74C00	.39	7475	.69	74LS40	.44	74LS193	1.04	4116	2.30
4019	.60	74C02	.39	7476	.45	74LS42	.58	74LS194	.81	4164	7.76
4020	.84	74C08	.39	7485	.69	74LS47	.67	74LS195	.81	8114	4.60
4021	1.51	74C10	.39	7486	.46	74LS48	.71	74LS196	.81	8116	3.97
4022	.96	74C14	.92	7490	.58	74LS49	1.38	74LS197	1.15	8118	4.54
4023	.36	74C20	.39	7492	.63	74LS51	.44	74LS221	.81		
4024	.71	74C30	.39	7493	.58	74LS54	.44	74LS240	.92	**74F Series**	
4025	.36	74C32	.39	7494	1.75	74LS55	.44	74LS241	1.15	74F00	.60
4027	.60	74C48	2.30	7495	.58	74LS73	.44	74LS242	.86	74F02	.60
4028	.96	74C73	.98	7496	.81	74LS74	.44	74LS243	.86	74F04	.60
2049	1.05	74C74	1.15	74107	.61	74LS75	.52	74LS244	1.38	74F08	.60
4030	.59	74C89	1.73	74109	.43	74LS76	.52	74LS245	1.61	74F10	.48
4035	1.20	74C90	1.35	74121	.53	74LS78	.58	74LS247	.83	74F32	.54
4040	.90	74C93	1.50	74123	.66	74LS83	.71	74LS248	1.77	74F109	.92
4042	.83	74C157	2.93	74125	.52	74LS85	.52	74LS249	1.38	74F164	1.67
4044	.71	74C174	1.44	74145	1.25	74LS86	.44	74LS251	.75	74F194	2.13
4046	1.20	74C175	1.44	74151	.58	74LS90	.60	74LS257	.58	74F245	5.41
4047	1.05	74C192	1.82	74154	1.73	74LS92	.60	74LS258	.58	74F374	3.51
4049	.53	74C909	2.65	74164	.69	74LS93	.69	74LS266	.52		
4050	.53	74C914	2.24	74165	.81	74LS107	.58	74LS279	.52	**Misc.**	
4051	1.09	74C915	1.63	74174	.58	74LS109	.52	74LS283	.69	95H90	10.06
4052	1.38	74C925	6.90	74175	.58	74LS112	.46	74LS290	.58	76489	7.73
4053	1.16	74C926	6.90	74191	1.14	74LS113	.52	74LS293	.58	76488	4.23
4056	1.13			74192	.58	74LS122	.69	74LS365	.58	76477	4.23
4060	1.93	**7400 Series**		74193	.96	74LS123	.81	74LS366	.81	TMS4500	26.45
4066	.58	7400	.46	74196	1.84	74LS125	.58	74LS367	.58	TMS9929	38.13
4068	.40	7401	.46	74365	.81	74LS126	.63	74LS368	.58	11C90	14.66
4069	.36	7402	.46	74367	.81	74LS132	.58	74LS373	1.15	AD570JD	49.11
4070	.36	7403	.46			74LS136	.76	74LS374	1.15	AD590JH	5.87
4071	.38	7404	.46	**74LS Series**		74LS138	.81	74LS386	.94		
4076	1.62	7405	.46	74LS00	.44	74LS139	.81	74LS393	.92		
4078	.40	7406	.52	74LS01	.44	74LS151	.58	74LS541	1.04		
4081	.55	7407	.46	74LS02	.44	74LS153	.52	74LS629	2.46		
4093	.56	7408	.46	74LS03	.44	74LS154	2.48	74LS640	2.47		
		7410	.46	74LS04	.44	74LS155	.69	74LS670	1.32		
		7411	.46	74LS05	.44	74LS157	.69				
		7413	.46	74LS08	.44	74LS158	.69	**Micro**			
		7414	.46	74LS09	.44	74LS160	2.30	6508	7.76		
		7417	.46	74LS10	.44	74LS161	.81	6800	5.75		
		7420	.46	74LS11	.44	74LS162	.81	6810	5.40		

SUPER LOW PRICES

SUPER BARGAINS AT MAGRATHS

SEAL OF SATISFACTION
MAGRATHS
WORLD OF ELECTRONICS

FAX-DECODER

This project allow you to decode the signals of shortwave stations, transmitting radio facsimile weather maps, satellite pictures etc and then reproduce them on your dot-matrix printer.

- Complete kits of parts includes DB15 Ribbon Cable
- SOFTWARE LISTING K9736

$24.50

ENAMELLED COPPER COIL WINDING WIRE

500 GRAM REELS

14	B&S	$8.30	25	B&S	$9.70
16	B&S	$8.17	26	B&S	$11.83
18	B&S	$8.42	28	B&S	$12.00
20	B&S	$8.69	30	B&S	$15.18
22	B&S	$9.11	32	B&S	$15.18
24	B&S	$9.32			

MAGRATHS ELECTRONICS Phone or Mail.
55 A'BECKETT STREET, MELBOURNE, 3000
Tele (03) 347 1122, Telex AA31001

Prices subject to change without notice.

bankcard welcome here

ALL ITEMS EX-STOCK AT THE TIME OF ADVERTISING

WAS $1,345.50/ NOW $1,210.95

EPSON HX-20 PORTABLE COMPUTER FROM MAGRATHS

The HX-20 portable computer package—you get a computer, a printer and a display unit—all in one, go anywhere, self-contained system.

LOOK AT THE FEATURES:

• FULL FUNCTION PORTABLE COMPUTER—NOT A CALCULATOR • STANDARD 16 KB RAM EXPANDS UP TO 32 K BYTES OR THE 32 KB ROM MEMORY TO 72 KB • ABLE TO COMMUNICATE • FULL SIZE ASC11 KEYBOARD • BUILT-IN PRINTER • LCD SCREEN • MUSIC GENERATION VIA PIEZO—ELECTRIC SPEAKER • MICROSOFT BASIC • TIME AND DATE FUNCTIONS.

For fixed location use you can also add on the following options—display controller for monitoring on large screens (even your home TV), floppy disk drive for expanded memory, and accoustic coupler for two-way information transfer.

SPECIFICATIONS:

Peripheral Interfaces	
Bar Code Reader	Special Connector
External Cassette	Standard audio cassette interface.
System Bus	16-bit address bus; 8-bit data bus and control lines; 40 pin connector.
ROM Cartridge/Microcassette Interface	1/10 port with 3 input, 6 output lines.
Power Supply	NiCd batteries; internal; Sub C type; 1200 mA/H capacity; 40 hour capacity running BASIC (less depending on use of RS-232C port, printer or optional microcassette).
Recharge	Full charge within 8 hours.
Physical Characteristics	
Size	29.0 x 21.5 x 4.4 cm (11.4" x 8.5" x 1.7").
Weight	Approx. 1.7 kg (3 lbs 13 oz.).
Options	
Expansion Unit	8 KB RAM plus 24 KB ROM or 16 KB RAM plus 16 KB ROM. Total expansion is 32 KB.
Microcassette	Uses standard microcassette tapes.
ROM Cartridge	Uses 8, 16 or 32 KB to load program into RAM.

INSTRUMENT CASES

BETACOM

	w	d	h	
IC 1-1	155	120	55	$16.79
IC 1-2	230	180	80	$26.40
IC 1-3	300	230	105	$38.01
IC 2-1	160	110	55	$8.23
IC 2-2	200	140	70	$10.95
IC 2-3	270	220	90	$18.24
IC 2-4	330	230	100	$23.95

EDDYSTONE DIECAST BOXES

7969P	92.1 mm	38.1 mm	27 mm	$3.61
6908P	119.1 mm	93.6 mm	52.4 mm	$5.83
6827P	187.7 mm	119.5 mm	52.4 mm	$9.32
6357P	187.7 mm	119.5 mm	77.8 mm	$12.35
9970P	187.3 mm	187.3 mm	63.5 mm	$21.74

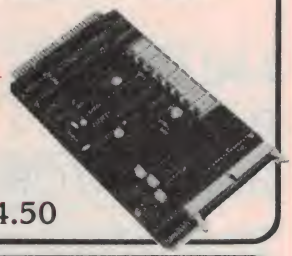
HORWOOD

H84/17V	430 mm	210 mm	100 mm	$18.89
H84/12V	305 mm	210 mm	100 mm	$15.71
H84/10V	255 mm	210 mm	100 mm	$14.51
H84/12V	305 mm	210 mm	100 mm	$16.78
H84/10V	255 mm	210 mm	100 mm	$15.42
H84/6V	150 mm	210 mm	100 mm	$13.37
H93/12V	305 mm	224 mm	75 mm	$15.90
H93/10V	255 mm	224 mm	75 mm	$12.79
H34/1/D	100 mm	25 mm	75 mm	$3.15
H34/2/D	100 mm	50 mm	75 mm	$3.30
H34/3/D	100 mm	75 mm	75 mm	$4.46
H34/4/DS	100 mm	100 mm	75 mm	$4.85
H34/6/DS	100 mm	152 mm	75 mm	$5.42
H34/8/DS	100 mm	200 mm	75 mm	$7.14
H34/10/DS	100 mm	255 mm	75 mm	$8.11

THE LITTLE BIG BOARD

KIT INCLUDES:

- Users Manual
- Printed Circuit Board.
- MP7A Monitor Prom.
- LB00T6 Boot Prom.
- Componet Set
- Set Up Sheet



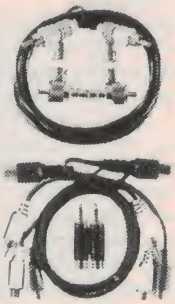
$494.50

ARISTA ELECTRONICS TV-VIDEO ACCESSORIES

Video Dubbing Kit.
For recording from any video machine to any video machine.

KIT INCLUDES:

Video Cable 1.5 m	1 PC.
Audio Cable 1.5 m	1 PC.
RCA-UHF Adaptor	2 PCS.
RCA-BNC Adaptor	2 PCS.
RCA-3, 5 mm Adaptor	2 PCS.
Cable Adaptor, 5 PIN DIN Plug to RCA Jacks (in/out)	2 PCS.



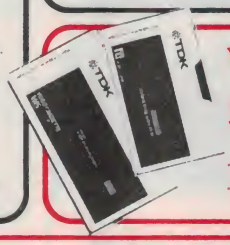
$16.11

ARISTA ELECTRONICS ALARM—SECURITY ACCESSORIES

MAGNETIC REED SWITCH
SCREW MOUNT

$3.22

VIDEO TAPE SPECIALS



TDK 3 HOUR VHS $15.45
TDK 3 HOUR BETA $15.45

NASHUA DATA DISKS

MD-1	SSD	5¼"	$39.67
MD-1D	SSDD	5¼"	$45.77
MD-2D	DSDD	5¼"	$52.73
FD-1	SSSD	8"	$46.57
FD-2D	DSDD	8"	$58.65

SPHERE COMPUTERS PRESENTS

AN INTELLIGENT TERMINAL

WAS $1,029.25 NOW $914.25

SPECIFICATIONS:

Keyboard
- Detachable, capacitive, typewriter-style keyboard.
- N-key rollover with auto repeat capability.
- 4 LED indicators for caps lock, on-line, block mode and keyboard lock/protect.
- Audible keyclick enable/disable.
- Auto repeat enable/disable.
- Keyboard lock enable/disable.
- Repeat rate 20 characters per second.
- 5 cursor control keys, 10 editing function keys with 14-key numeric key-pad.

Communication
- Code: 128 ASC11 characters.
- Baud rate: 75, 110, 150, 300, 600, 1200, 1800, 2400, 4800, 9600, 19,200.
- Parity: Odd, even, mark space.
- Operating Mode: Full duplex, half duplex or block mode.
- Interface: EIA RS-232C or 20-mA Current Loop.

Emulation
- LEAR SIEGLER ADM-3A, HAZELTINE 1500, ADDS VIEWPOINT.

Screen Presentation
- Display format: 24 lines x 80 characters.
- Display unit: 12-inch, non-glare Green CRT.
- Character type: 7 x 9 dot matrix.
- Refresh rate: 50/60 Hz.
- Character set: 96 ASC11 characters, 51 graphic symbols, 32 control character symbols.
- 5 screen attributes: Blink, underline, blank, reverse, dual intensity.
- Cursor type: Selectable slow, fast blinking or steady cursor, block, underline or invisible cursor.

Editing Function
- Cursor: up, down, left, right, home.
- Insert character, delete character, insert line, delete line, erase to end of line, page and field, field tab, field back tab, column tab, column back tab, block mode on/off, protect mode on/off, graphic mode on/off, clear unprotected.

External Control
- Power on/off.
- Contrast adjustment.
- Baud rate.
- Parity and data format
- End of message.
- Emulation mode.
- Refresh rate.
- Half duplex or full duplex.
- Auto line feed.
- Auto new line.
- EIA or 20-mA Current Loop.
- Reverse video or standard video.

FANTASTIC VALUE

—Mail or phone orders add $2.00 up to 1 kg pack post
Special rates for **heavy** items on request.

ARLUNYA PATTERN GENERATORS

The Arlunya PG100Z series of pattern generators produce video signals for testing VCRs, VTRs, monitors, TV receivers and CCTV systems operating to Pal standards.

All versions give eight monochrome and ten colour patterns with override controls providing superimposed variable size circle, spot, porthole, chroma level, burst level and interlace or non interlace selection.

Patterns include: crosshatch, dots, checkerboard, vertical bars, horizontal bars, multi burst, resolution bars, linear gray scale, standard colour bars, white-red-green-cyan and plain rasters, chroma decoder pattern, chroma staircase, chroma resolution and 'colour black'.

Outputs are video, RF (switched and variable for most VHF and UHF TV channels) and trigger.

The PG100XB model provides slaving from any colour SPG generating subcarrier and standard pulses thus enabling broadcast format signal generation in combination with a broadcast station SPG. A rear internal/external switch determines operating mode.

PG100XP provides slaving facilities from the Arlunya VPS210 video processor with which it is mainframe compatible.

Versions are available with separate RGB outputs for testing monitors that require such signals. Other versions can be supplied with multiple outputs with or without superimposed number character identification.

For further information, contact: **The Dindima Group Pty Ltd, PO Box 106, Vermont, Vic 3133. (03) 873-4455.**

NEW LOW VOLTAGE HEXFET

International Rectifier, whose products are distributed in Australia by Warburton Franki, has introduced a new low R_{DS} (on) 60 V HEXFET.

Designated the IRFZ32, the FET has a maximum R_{DS} (on) of 100 milliohm and incorporates the quality and reliability benefits of HEXFETs including .04% AQL, the company claims.

They say that this is due, in large part, to product design factors such as wire bonding pads, solder die attach, epoxy package, passivated die and proven device structure.

Particular features of the IRFZ32 include, extremely low R_{DS} (on), compact plastic package, fast switching, low drive current, ease of paralleling, no second breakdown, excellent temperature stability and excellent parts per million quality.

For full specification details on this latest addition to the HEXFET range, contact **Warburton Franki, 199 Parramatta Rd, Auburn NSW 2144.**

1 GHz FREQUENCY COUNTER FROM AWA

The LDC-825 from AWA is a digital frequency counter made by Leader capable of measuring frequency over the wide range 10 Hz to 1 GHz and period 100 mS to 1 μS.

Featuring bright 7-segment fluorescent displays the 8-digit readout provides resolution of 0.1 Hz up to 80 MHz and 10 Hz up to 1 GHz.

The high sensitivity of 20 mV up to 80 MHz and 50 mV, via the 50 ohms input of the prescaler, combine with the accurate time base of ± 3 in 10^8 to make the LDC-825 suitable for many applications in production testing and service of radio-communications systems.

The counter is small and lightweight and can be used over the temperature range 0 to 40°C. It is mains operated and supplied with two input cables and comprehensive operating instructions.

Further information is available from **Amalgamated Wireless (Australasia) Ltd, North Ryde Division, Cnr Talavera & Lane Cove Roads, Macquarie Park, North Ryde NSW 2113. (02)887-7111.**

WAVETEK FOR SCIENTIFIC DEVICES

COMMENCING on the 25th day of December, 1983, Scientific Devices Australia Pty Ltd was appointed the new Australian representative for Wavetek Corporation USA.

Wavetek, with the addition of two new divisions to their structure, namely Nicolet Scientific Corporation and Pacific Measurements, is one of the largest instrumentation suppliers in the USA.

Their products include FFT analysers, synthesisers, programmable filters, RF signal generators, RF components, RF sweep genertors, microwave generators, instrumentation controllers, pulse/function generators, arbitrary programmable generators, instrument controllers, network analysers and power meters.

Scientific Devices offer marketing and support for Wavetek products with full service facilities. Contact Scientific Devices Australia Pty Ltd for further information on this appointment at any one of the offices in Melbourne, Sydney or Adelaide.

H-P's RF SIG GEN FAMILY

Hewlett-Packard describes its family of RF signal generators in a new eight-page, four-colour product brochure providing key features and benefits of each instrument.

Included in the brochure are selection guides based on both applications and specifications for each of the programmable and manually-tuned generators and a spectral-purity-comparison graph. The literature number is 5953-8383. Enquire at your local H-P office. ●

FOR QUALITY, PERFORMANCE & VALUE, AARON MUST BE YOUR FIRST 'SCOPE CHOICE

(and for after sales service too!)

1 BS601 - 20MHz/5mV with Built-in Component Tester

$535 ex tax $620.20 tax paid

- Check components on screen
- 19 range timebase • Triggers to over 30MHz • 17nS risetime

2 BS810 - 100MHz/1mV with 4 Channels and 8 Traces

$2295 ex tax $2708.10 tax paid

- 2nS/div max sweep time
- Alternate time base with B ends A mode • Variable trigger hold-off
- Independent position controls
- Signal delay

3 BS625 - 45MHz/1mV with Signal and Timebase Delay

$1095 ex tax $1270.20 tax paid

- Single sweep • Trigger delay
- 7.7nS risetime • X, Y, Dual, Chop, Add, Subtract etc

4 BS310S - 15MHz/2mV Battery Portable

$795 ex tax $922.20 tax paid

- Ideal for field service use
- 2 hour operation from built-in NiCads • Automatic re-charging
- Auto trigger free run • TV sync

5 BS320 - 15MHz/2mV with Digital Storage and DMM

$2295 ex tax $2708.10 tax paid

- Built-in 3½ digit multimeter
- Digital storage mode • Trigger delay • X-Y mode component tester • 3 channel operation for 3-phase measurements

6 BS635 - 35MHz/1mV with Alternate and Delayed Timebase

$875 ex tax $1015.00 tax paid

- 21 range timebase • 100mS-1uS trigger delay • Front panel trace rotate • Multi-mode display

Optional carrying cases available for all 'scopes.

Coline Probes

A comprehensive range of probes and accessories is available. Modular types have pencil slim heads and detachable earth leads. They offer excellent pulse responses and very wide bandwidths. A comprehensive catalogue is available on request.

SP100 - 100MHz Probe

$28 ex tax $32.20 tax paid

With x1, ref, x10 positions. 1.5m lead, BNC connector and selection of tips in heavy duty pouch.

All prices are plus sales tax if applicable and subject to change without notice.

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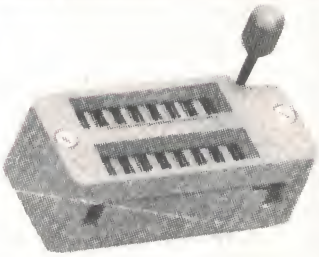
TEXTOOL ZERO INSERTION FORCE SOCKETS



ZIP DIP II Sockets

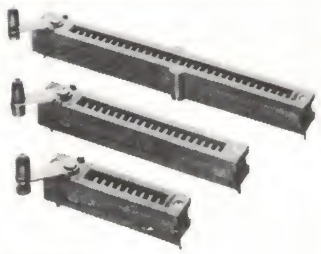
TEXTOOL'S versatile ZIP DIP II socket features a flat top plate for easy insertion and extraction. Contacts are on .1" increments for standard sizes, thus mating with standard layouts. All standard sizes from 14 to 40 pin are available from stock at realistic prices.

Pins	Stock Number	Price
14	PB01	9.10
16	PB02	9.74
18	PB03	9.31
20	PB04	9.96
22	PB05	14.10
24	PB06	7.25
28	PB07	7.50
40	PB08	11.95
64	PB28	29.70

ECONO-ZIP Sockets

For applications requiring low cost for not so often used sockets the ECONO-ZIP is the answer. A simple mechanism is used with contacts and body of standard TEXTOOL materials. Ideal for use on P.C.B.'s within equipment for PROMS or EPROMS. Available immediately in 16, 24, 28 and 40 pin, others to follow.

Pins	Stock Number	Price
16	PB20	6.97
24	PB24	6.83
28	PB25	9.11
40	PB26	11.37
64	PB29	13.50



ZIP-STRIPS

Combine all the usual TEXTOOL features into a useful socket for testing non-standard packages or pinned board assemblies. The ZIP-STRIP handles may be ganged for ease of use.

Pins	Stock Number	Price
10	PB17	11.30
20	PB18	14.98
32	PB27	17.01

All above prices plus 20% sales tax

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HIGH SPEED DIVIDERS REACH 3 GHz

Plessey semiconductors of Swindon, southern England, has announced availability of prototype samples of an emitter-coupled logic (ECL) divide-by-four device for operation above 2 GHz.

Known as the SP8712 EXP, it is the first fully production specified divider of its type. Full production will start shortly, the company say.

Operation is guaranteed at input frequencies up to 2.4 GHz, and under ideal conditions a typical device will achieve almost 3 GHz which, say Plessey Semiconductors, represents an improvement in frequency performance of 50 per cent in less than two years and is indicative of major advances in silicon ECL technology.

An important feature of the SP8712 is that it is supplied in a conventional dual-in-line package so that it can be mounted on a printed circuit board, along with accompanying components. It had been thought that DIL packages were unsuitable for operation above 1.5 GHz because of the length of bond wires between the chip and the package leadouts. However, experience gained from manufacture of the SP8612 has shown otherwise.

The design of the SP8712 EXP features a carefully designed chip layout which matches the input stage with the self-inductance of bond wires. This means that the SP8712 EXP can be operated in a conventional manner using conventional board assembly techniques.

Like other Plessey SP8000 series high speed dividers, the SP8712 EXP is guaranteed to operate over a defined temperature, supply voltage, input voltage and frequency range with no compromise in performance.

As well as the applications in professional test and measurement equipment, the SP8712 EXP is ideal for use in direct broadcast satellite (DBS) systems, say Plessey. Present DBS systems used in the USA require a divider to perform at 2 GHz with a typical IF frequency.

The ability to divide at higher frequencies will now allow the user of higher IF frequencies, with a resulting improvement in performances. European systems are planned to operate at even higher frequencies and the introduction of the SP8712 EXP now makes this possible.

For further information contact **Plessey Semiconductors Limited, Cheney Manor, Swindon, Wiltshire, England SN2 2QW. Telephone (079)3-6251.**

UHF POWER TRANSISTORS

Motorola has announced the new MRF652 and MRF841, cost-effective, high gain UHF and 800 MHz mobile radio RF power transistors.

The devices provide 8.5 to 10 dB minimum gain and 65% typical efficiency specified at 5.0 W output power and 512 or 870 MHz.

These new transistors also feature improved ruggedness, which is 100% tested at high supply, over drive and 30:1 VSWR. Both the MRF652 and MRF841 are designed primarily for driver and output stages in land mobile and hand held radios operating in the UHF and 800 MHz frequency bands.

These devices provide at least 1 dB more gain than previously existing RF power transistors, thereby significantly reducing the cost of driver stages, claim Motorola.

These devices are available from **Motorola Semiconductor Products, 250 Pacific Hwy, Crows Nest NSW 2065. (02)438-1955.**

TRW SECOND-SOURCE OPTOCOUPLERS

TRW Electronics Components Group, Opto-electronics Div, has unveiled alternate sources for the 6N Series of optocouplers. The five-member series is available off the shelf in eight-pin DIPs with temperature compensation over the 0° to 70° Celcius range and 3000 Vdc isolation.

The high speed 6N135 and 6N136 have open-collector outputs for use as line receivers and isolators in applications having data rates of up to one megabit. The high-gain 6N138 and 6N139 devices are said to provide high sensitivity for EIA RS232C line-receiver and telephone-ring detection.

The ultra-high speed 6N137 device is an optically-coupled logic gate designed for digital-interfacing applications and usable for 10 megabits.

For further information contact **Total Electronics, 9 Harker St, Burwood 3125 Vic. (03)288-4044.**

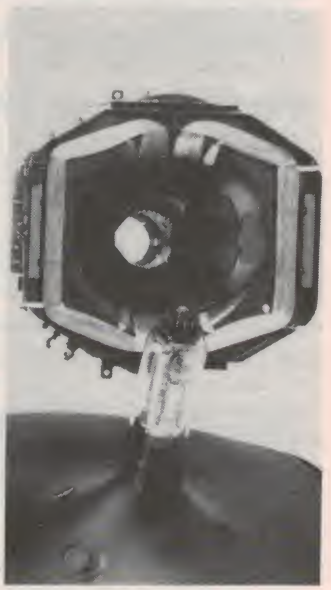
IMPROVED CONVERGENCE FOR 30AX TV SYSTEM

Improved convergence for their 30AX TV tube deflection system is announced by Philips. Convergence improvement over previous data is 10-20% for the three new deflection units, type numbers AT1850 (20″), AT1860 (22″) and AT1870 (26″).

Several improvements have been made in the deflection units, including a new winding technique, which gives better control of tolerances during production. The 22″ coil also now includes field shapers.

Samples of the 22″ and 26″ deflection units are available now; samples of the 20″ unit will be available by the end of the year.

For further information, contact **Philips Electronic Components & Materials, 67 Mars Road, Lane Cove NSW 2066. (02) 427-0888.**



AVTEK MULTI MODEM

SEE EA JAN. 1984

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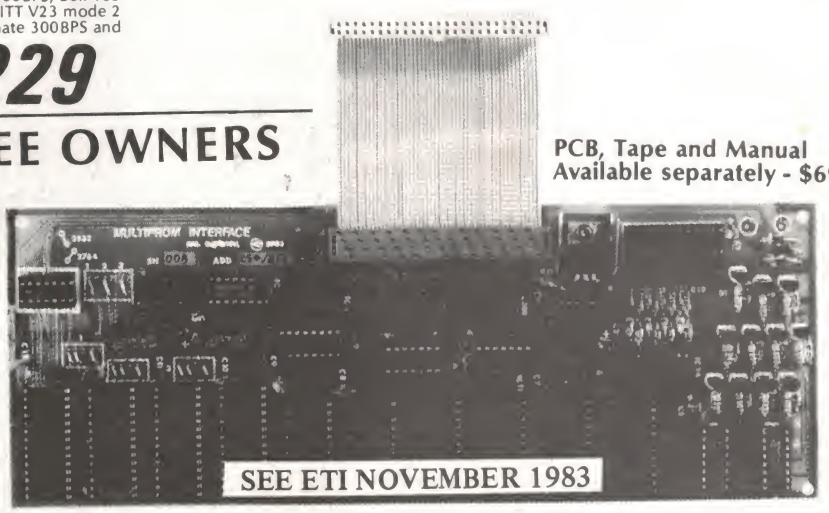
MULTIPROM INTERFACE KIT $99



PCB, Tape and Manual Available separately - $69

The Multiprom board is an extension of the Microbees memory in ROM. It simply plugs into the fifty way bus expansion port on the core board. It fits either neatly inside the Microbee or behind it, using the Microbee's own power supply.

The board takes the EDASM and NET eprom normally residing inside the Microbee, but allows several different sets to fit in: Editor-Assembler, Wordbee, Logo, MiniPascal, Network ROM, Bemon or your own program. It has room for 4 sets of eproms in the EDASM location and 3 sets of eproms in the NET location, a total of 44K of eprom. The board can be simply daisy chained with up to 6 slave boards (using an outside power supply in this case), allowing a maximum total of 308K in ROM. The EDASM locations accept either type 2532 or 2764 eproms and they can be mixed. Another powerful feature of the board is the input/output system, 11 outputs, open collector transistor driven. Each can turn ON or OFF a relay under program control. 8 inputs, buffered and protected can read 8 switch status - ideal for computer controlling of model trains, alarm systems, tape recorders, machinery etc.

The Avtek kit includes a plated through board plus all components to make this exciting project. There is also provision on the board to change the address of the ports used for eprom selection and input/output.

Little BIG Board

SEE ETI OCTOBER 1983 FOR FULL DETAILS

The Pulsar Series 6000 microcomputer card has been designed to provide a cost-effective general purpose central processor that will find application in a wide range of systems, from stand-alone and dedicated control processors to multi-processing and network configurations. While the 6000 Series is fully compatible with the industry standard STD bus, attention was given to partitioning the circuit so that a complete disc-based computer system could be constructed using just one card. Included on the board is: Z80A processor operating at a full 4MHz, 64K bytes dynamic RAM, single/double density floppy disc controller, two RS232C serial I/O ports, 2K bytes EPROM bootstrap/monitor and battery-backed real-time clock and calendar. Interfacing to the STD bus allows systems to include modules from a range of over 1800 cards available from some 80 manufacturers.

Card Includes:
- **Power-on automatic bootstrap to CP/M in on-board EPROM**
- **Real time clock chip with battery backed supply**

BUS Interface:
- **All signals meet STD Bus electrical specs.**

External Connections:
- **50 way edge connector provided for 8" floppy disc connections**
- **1 x 16 pin RS232C for terminal conn**
- **1 x 16 pin RS232C for printer connection**

PCB, Manual and ROM $149

FULL KIT $450

CP/M in 8" or 5¼" 1200 or 9600 Baud (please specify) ONLY $150

NEW KIT - SERIAL TO PARALLEL CONVERTOR

SEE ETI JANUARY 1984

KIT without Centronics Connector $29

KIT with pre-crimped Centronics Connector and lead $59

MULTI ROM BOARDS

XM-1 - This is a totally new product developed EXCLUSIVELY for AVTEK - It takes two sets of EPROMs (e.g. WORDBEE and EDASM) and allows you to choose between them by simple KEYBOARD COMMANDS. It will take a short time to assemble and is simply installed inside the MICROBEE with one DIP plug (supplied) and two solder connections.
Suits early model MICROBEE plus models using 2532 type EPROMs.
These have serial numbers starting with 8.

SAVE $$4.95 - NOW ONLY $15.00

XM-2 - same as XM-1 but suits the MICROBEE IC and is even simpler to fit. Also responds to PAK1 and PAK2 commands.
These have serial numbers starting with 9.

SAVE $1.95 - NOW ONLY $15.00

EPROM PROGRAMMER

See ETI January 1983

Plugs straight into the MICROBEE I/O port. Suitable for 2716, 2732, 2532, 2732A and 2764 EPROMs. Burn your games programmes and eliminate cassette loading time.

FEATURES: ● Sockets for all other IC's ● 1 x 2716 supplied - get started straight away ● Front panel and mains (SEC approved) transformer ● 28 pin and 16 pin wire wrap sockets to flush mount personality plugs (2 included) and ZIF socket (included) ● DB15 plug ● Complete to last nut and bolt ● See review ETI August 1983.

ONLY $55.00

RADIOTELETYPE DECODER

See ETI April 1983

Display RTTY encoded messages on your video monitor. Receive up to date weather information, International news before the papers and all sorts of military info. Simple circuit, uses PLL techniques. Single PCB construction. Kit includes DB15 plug and backshell for connection to MICROBEE. Shielded pre-tinned PCB.

ONLY $19.50

MICROBEE LIGHT PEN

See ETI August 1983

AT LAST! A light pen for the BEE. This pen works in the low resolution graphics mode and connects directly from the I/O port. Complete kit including DB15 and 2m cord. Fully documented with software example.

PROVIDES DIRECT PERSONAL CONTACT WITH YOUR BEE!

ONLY $19.95

FAX DECODER

See ETI September 1983

This project allows you to decode the signals of shortwave stations transmitting radio facsimile weather maps, satellite pictures etc., and then reproduce them on your dot matrix printer. Complete kit of parts includes DB15 and ribbon cable. Software listing.

ONLY $24.50

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DAP PRECISION POTS

Novotechnik KG of Ostfildern, Western Germany, manufacturers of precision potentiometers, are using diallylphthalate (DAP) for base plates in their 'Dino-pot' potentiometers. This high quality plastic is a product of Synres-Almoco BV of the Netherlands.

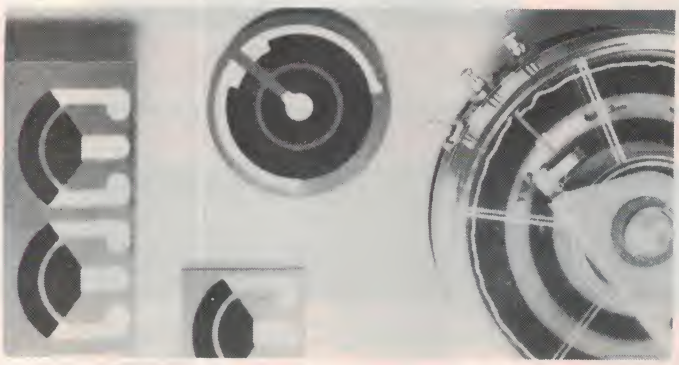
More than ever before, electronic components demand high reliability and quality. In particular, materials used in high performance process control equipment have to meet rigorous requirements.

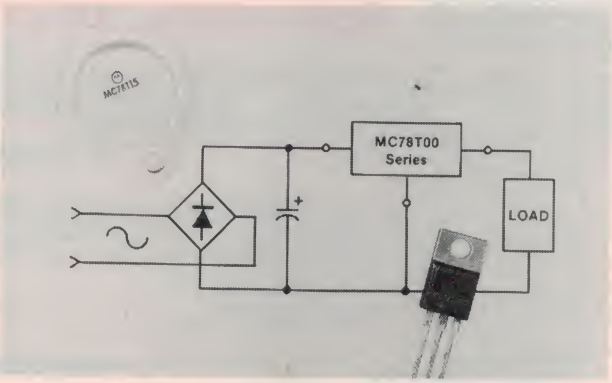
Heat resistance and dimensional stability up to temperatures of 180°C combined with excellent resistance to oil and water were essential basic requirements. Further, as the sliding contact is to be capable of 100 million movements, a high degree of wear resistance in the conductive trace is necessary.

As their conductive traces are also based on a diallylphthalate resin system and are chemically bonded to the DAP substrate during the moulding operation, a completely unified system is achieved with a flat, mirror smooth surface.

The electrical insulation performance of DAP meets the highest requirements. More importantly, it retains these excellent properties even under extreme conditions, such as high humidity at elevated temperatures.

In the automotive and transport industries, electronic accelerator pedals and anti-jacknife systems for flexibuses are already being developed. Projects involving stroke adjusting panels for industrial machines and control devices for electronic systems are also underway.





VOLTAGE REGULATORS

Motorola has introduced a family of fixed output, three-terminal voltage regulators with a load driving capability in excess of 3.0 amps.

The Motorola MC78T00 series of devices are available in 5, 6, 8, 12, 15, 18 and 24 volt versions. These devices provide improved load and line regulation over existing industry products and have guaranteed limits for thermal regulation and ripple rejection, Motorola claim.

The Prime Grade (A-Suffix) devices of the MC78T00 series offer even tighter specifications on many of the electrical characteristics, including a 2% output voltage tolerance. For example, the Prime Grade, 5 V devices (MC78T05AC) have a load regulation within 25 mV over the entire load range and line regulation (output voltage variations due to line input voltage changes) is less than 10 mV.

All of these monolithic devices employ internal current limiting, thermal shutdown, and safe area compensation. Although designed as fixed voltage regulators without external components, these devices can be used with additional components to obtain adjustable voltages and currents. This series of regulators can also be used with a series-pass transistor to boost its standard 3.0 ampere output to 15 amperes.

Devices are offered in standard and A-suffix versions, plastic TO-220 (T-suffix) and metal can TO-3 (K-suffix) packages, and in two temperature ranges. Information can be obtained from **Motorola Semiconductor Products, 250 Pacific Hwy, Crows Nest NSW 2065. (02)438-1955.**

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KIT PRICE $319 P&P $12.00

• 1% Metal Film Resistors are used where possible • Prewound Coils are supplied • Aluminium case as per the original article • All components are top quality • Over 400 Kits now sold • We have built this unit and so know what needs to go into every kit • SUPER FINISH Front panel supplied with every kit at no extra cost to you. • We are so confident of this kit that we can now offer it assembled and tested so that people who do not have the time can appreciate the sound that this amplifier puts out. This is done on a per order basis delivery approx. four weeks after placement.

PREAMPLIFIER **Only $449**

KIT PRICE $289 P&P $12.00

• 1% Metal Film Resistors are supplied • 14 metres of Low Capacitance Shielded are supplied (a bit extra in case of mistakes) • English "Lorlin" Switches are supplied no substitutes as others supply • We have built and tested this unit and so know what needs to go into every kit • Specially imported black anodised aluminium knobs • Again as with the power amp we are offering this kit A & T at a price which we do not believe there is a commercial unit available that sounds as good. Same delivery as the PA.

PREAMPLIFIER Kit Price $289, P&P $12.00

SPECIFICATIONS

Frequency response:	High-level input: 15Hz-130 kHz, +0, −1 db Low-level input — conforms to RIAA equalisation, ±0.2 dB
Distortion:	1kHz <0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation).
S/N noise:	High-level input, master full, with respect to 300 mV input signal at full output (1.2V): >92 dB flat >100 dB A-weighted. MM input, master full, with respect to full output (1.2V) at 5 mV input, 50 ohm source resistance connected: >86 dB flat >92 dB A-weighted. MC input, master full, with respect to full output (1.2V) and 200 μV input signal: >71 dB flat >75 dB A-weighted.

On Special at $259
Normally $289

**All parts available separately for both kits.*

POWER AMPLIFIER Kit Price $319, P&P $12.00

SPECIFICATIONS 150W RMS into 40hms

Power output:	100W RMS into 8 ohms (±55 V supply).
Frequency response:	8 Hz to 20 kHz, +0−0.4 dB 2.8-Hz to 65 kHz, +0−3 dB. NOTE: These figures are determined solely by passive filters.
Input sensitivity:	1V RMS for 100W output.
Hum:	−100dB below full output (flat).
Noise:	−116 dB below full output (flat, 20 kHz bandwidth).
2nd harmonic distortion:	<0.001% at 1 kHz (0.0007% on prototypes) at 100 W output using a ±56 V supply rated at 4 A continuous. <0.003% at 10 kHz and 100 W.
3rd harmonic distortion:	<0.0003% for all frequencies less than 10 kHz and all powers below clipping.
Total harmonic distortion:	Determined by 2nd harmonic distortion (see above).
Intermodulation distortion:	<0.003% at 100 W. (50 Hz and 7 kHz mixed 4:1).
Stability:	Unconditional

Please note that the "Superb Quality" Heatsink for the power amp was designed and developed by Rod Irving Electronics and is being supplied to other kit suppliers. This product cost $1,200 to develop so that your amplifier kit would have a professional finish as well as sound.

On Special at $299
Normally $319

MX-1200 MICROPHONE/AUDIO MIXER

This unit features: 12 microphone line inputs with pan, bass, treble, effect and fold back controls for each channel • LED peak indicators for each channel • 2 turntable inputs with cross-fade and individual output controls • master equaliser for bass, midrange and treble • variable headphone output etc. etc. • complete with carrying case.

$799⁰⁰

SPECIFICATIONS:
INPUTS
Level/Impedance Mic. 46 db/1K
Line 22 db/16K x 12
Phono 52 db/50K STEREO x 2 (.2mv) at 1KHz
Effect Return (Aux) 20 db/50K x 1
OUTPUTS
Level/Impedance L & R 0 db/2K
Effect Send 0 db/2K F/B Out 0 db/2K
Head phone Stereo +10 db/600 (100..1K)
EQUALISATION
Channel
Bass ±15db
Treble ±15db
Master
Bass ±12db
Treble ±10db
Middle ±12db

FADER & CONTROLLERS
12 channel fader; Slide, 60m/m. LOG 25%
2 Master fader; Slide, 60m/m; LOG 15%
12 F/B Volume, 300; LIN
1 F/B Master level; 300; LIN
12 Effect Send; 300; LIN
1 Effect Return; 300; LOG 15%
2 Phono; 300; LOG 15%
1 Head Phone; 300; LOG 15%
S/N: 58DB
FREQUENCY RESPONSE: 20-20 KHz
TOTAL HARMONIC DISTORTION: Less than 0.1%
METER: 2 illuminated VU Meters 0db = 0.775V
PEAK INDICATOR: 12 LED Peak Indicators
VOLTAGE 240 VAL 50Hz
POWER CONSUMPTION: 7.2 watts
DIMENSIONS: 620 (W) x 386 (D) x 108 (H) mm (supplied complete with carrying case)

THIRD OCTAVE GRAPHIC EQUALIZER

SPECIFICATIONS E.T.I. Dec. 1982

Bands:	28 Bands from 31.5 Hz to 16 kHz
Noise: 20 kHz bandwidth	<0.008 mV, sliders at 0, gain at 0 (−102 dB),
Distortion:	0.007% at 300 mV signal, sliders at 0, gain at 0; max. 0.01%, sliders at minimum.
Frequency Response:	12 Hz-105 kHz, +0, −1 dB, all controls flat.
Boost & Cut:	14 dB

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$379⁰⁰ 2 Units

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Design and construction of several solid-state shortwave receivers giving high level of performance yet utilising few components.

constructional projects

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Some circuits are new, others are familiar designs. Projects can be split and/or combined.

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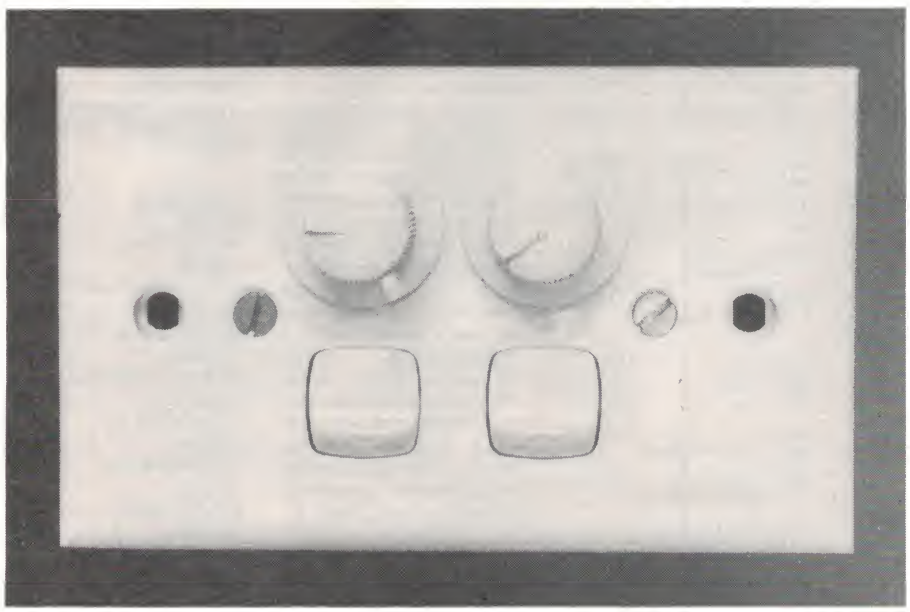
Project 1522

Control up to four room lights over a twin-wire cable

Ian Thomas

Part 1

It is probably a not-uncommon problem to want to replace the single ceiling light in a room with a more exotic dimmable arrangement only to find that the twin-wire switch cable is concreted in, or otherwise hard to get at without spoiling the room decoration. This project allows you to control up to four room lights — two dimmable and two switched — over the existing twin-wire cable. No need to spoil the wall and ruin the room decor.



The controls. I modified a standard, commonly available, HPM light fitting (made in Australia) to take the controls. This provided a neat and convenient solution, the switches and dimmer pots snap into the panel, the encoder pc board mounts behind them. The end result is only distinguishable from an 'ordinary' light fitting by the two pc board mounting screws visible here (which should be earthed or covered). If the pc mountings are epoxied in place — who'd know the difference?

IT IS PROBABLY a not uncommon problem to want to replace the single overhead light fitting with a more exotic dimmable arrangement only to find that the control wires to the switch are *concreted in*. Also, in keeping with Murphy's Law, the walls have only been re-papered a year or so ago and the wallpaper is now totally unavailable and to string more wires to the switch would involve a major redecoration of the whole room, so the idea is scrapped.

This project is intended to solve such problems by replacing the single wall switch with the required multiple switch-control pot combination and a very compact printed circuit board. A matching electronics box in the ceiling feeds power to the control board and also recovers the control information to operate triacs to drive the multiple lights.

It was considered essential that the replaced wall controls look exactly like normal 'bought' controls and avoid that 'home made' look so, normal, purchased, wall fittings were used for the controller. The unit in the ceiling merely had to work reliably and could be any size or shape at all.

The design

The first problem to be dealt with in the design was how many controls and what type were wanted. Also, it had to be decided how to multiplex the switch/control pot information onto the single wire pair available. A survey of the many types of controller integrated circuits available (what we were trying to do is not dissimilar to the remote control of a TV or VCR) showed that while there were dozens (literally!) manufactured, precisely none (zip! zero! zilch!) were to be had in Australia unless you wanted to buy 1000 or so.

The only ray of light to be found was from National Semiconductor, and a perfectly satisfactory ray it turned out to be too. National make the LM1871 Radio Control Encoder/Transmitter and its companion LM1872 Radio Control Receiver/Decoder, which are intended to be used as remote controllers for toy cars or model aeroplanes. They provide, in their simplest configuration, two linear analogue control

channels plus two separate on-off channels The encoder/transmitter also contains a moderate power high-f_T transistor to be used as an RF transmitter and the receiver/decoder has all the circuitry to construct a (simple) RF receiver so, as I could actually go out and buy some over the counter (good marketing National!) this integrated circuit pair seemed to be the way to go. They would give two completely linear, dimmable lights plus two simple on-off lights which should cover most rooms adequately.

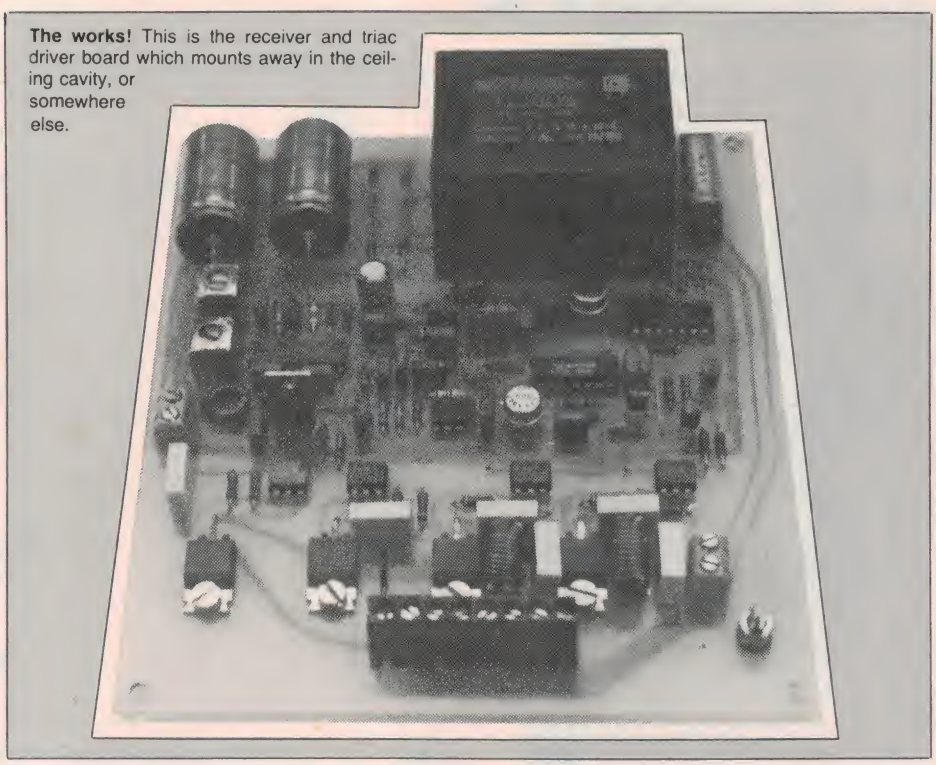
The LM1871/LM1872 integrated circuits operate on a rather peculiar combination of pulse-width modulation plus (once again in their simplest configuration) pulse counting to transmit the analogue and digital information. The receiver/decoder half of the pair contains no memory so the encoder/transmitter must send the information continuously to keep the system 'alive'.

The encoder section of the LM1871 generates a series of up to six pulses in each data frame with each pulse separated by a fixed off time. At the end of the up-to-six pulses a much longer synchronisation pulse is sent so the receiver/decoder can lock on correctly. The first two pulses in each data frame are of variable width to convey the analogue information of the two channels and the other, up-to-four, fixed width pulses give the status of the two on-off switches. Figure 1 shows a typical encoder output and indicates how the width of the first two pulses gives the analogue data.

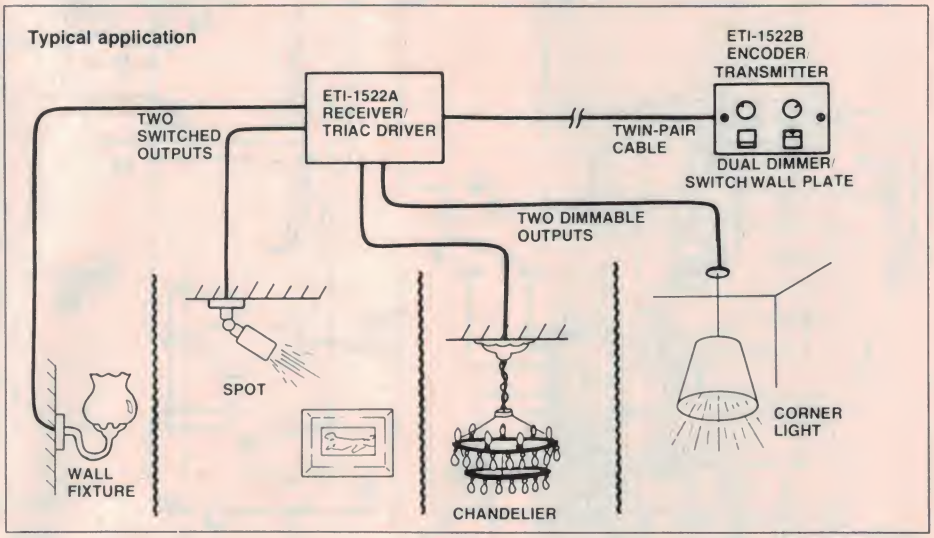
As Figure 1 shows, the analogue information is contained in pulses repeated at the frame rate whose width varies. The values recommended by National give a frame rate of 50 Hz. However, as the analogue information derived from this repetition rate data is to be used to control triacs running from 50 Hz mains the two similar frequencies would be sure to give rise to all sorts of unwanted slow beat effects (you would be amazed how sensitive the eye is to slow beats in, say, light intensity). For this reason I opted to have a frame rate of 75 Hz so any beats would be at 25 Hz and thus unnoticeable.

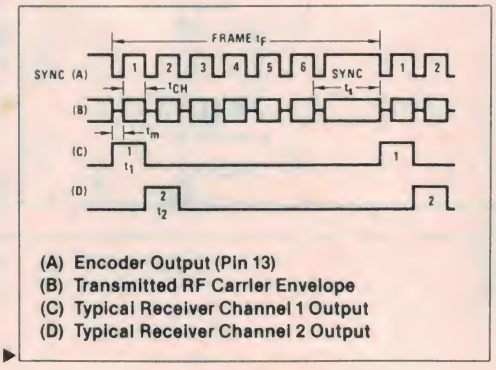
Also, the National design data is based on bandwidth restrictions and no such restraints exist for us. I also opted to shorten the fixed off time between all pulses to 0.4 ms from the National-recommended 0.5. The analogue channel limits were left the same as in the recommendations at 1 ms minimum and 2 ms maximum. The digital information pulses were left at 0.5 ms to finish defining all the times in the frame sent from the encoder.

The LM1871 is intended to be used as a very low power 27 MHz or 46 MHz (or, by straining and a bit of extra circuitry, 72 MHz) radio transmitter. This seemed like a good idea except that I had no desire to further crud up the ether with lighting control information. Instead, I chose to use the wires carrying power to the controller to carry switched low frequency RF data in the ▶



The works! This is the receiver and triac driver board which mounts away in the ceiling cavity, or somewhere else.

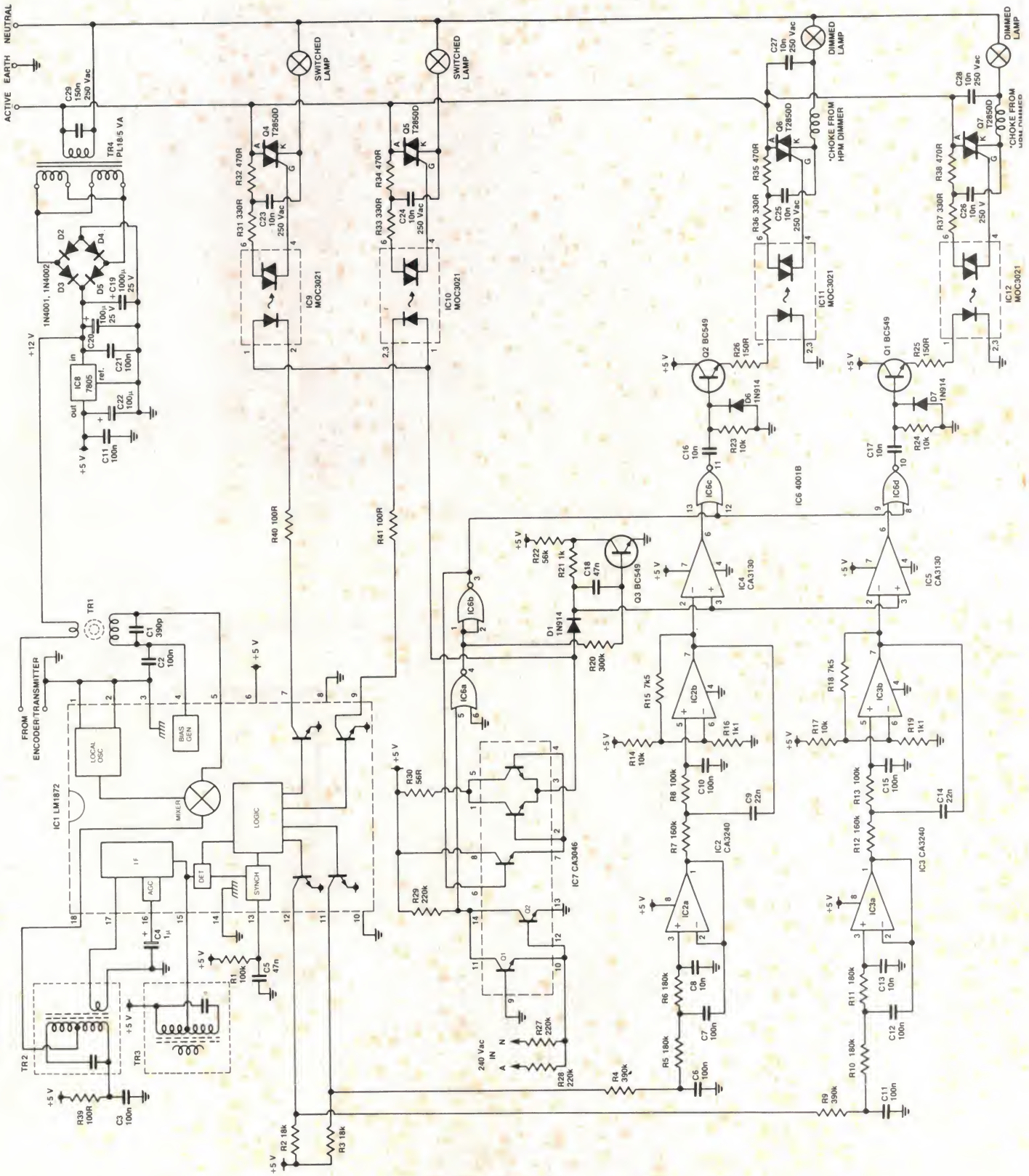




(A) Encoder Output (Pin 13)
(B) Transmitted RF Carrier Envelope
(C) Typical Receiver Channel 1 Output
(D) Typical Receiver Channel 2 Output

Figure 1.
Typical encoder output waveform. The width of the first two pulses gives the analogue data.

Circuit of the receiver and triac driver (ETI-1522A)



HOW IT WORKS — ETI-1522

The light controller can be divided into two major sections; the transmitter and the receiver and the receiver itself can be divided into several sections which are: the RF receiver, analogue filtering, mains synchronisation and triac drive. First, consider the transmitter.

The transmitter sends its information as to potentiometer position and switch status by sending a series of between three and six data pulses followed by a much longer pulse to synchronise the system (see Figure 1). All the pulses are separated by an off period of exactly the same time. The first two pulses are individually pulse-width modulated to encode the two analogue channels and the next one-to-four pulses contain the switches, encoded by a simple counting system. As the width of the first two pulses and also the number of subsequent pulses can vary, the actual time taken for data transmission varies as the input controls are varied. However, the LM1871 allows for this by varying the length of the synchronising pulse so the length of every data frame is the same.

While it is interesting to go into details of the internal operation of the LM1871 the essential part is to understand how the external components affect the operation of the integrated circuit. The IC consists of several separate RC timing circuits and some combining logic, together with voltage reference generators to give both stable timing and stable RF output level. Overall data frame timing is set by R8 and C10 and this time constant sets the 75 Hz data rate for the system. The time between each individual pulse of the data and the duration of each data pulse is set by capacitor C11, together with different resistors for the inter-pulse time and the actual pulse durations.

When the LM1871 is measuring the time between the pulses it is charging C11 from 0.33 V_{ref} to 0.67 V_{ref} by switching in R1. When the LM1871 determines an actual pulse it discharges C11 through the resistor associated with that pulse. For example, when it sets the length of the first pulse in the data frame it switches in the resistance connected to pin 3, which is R7 and RV2. Thus, R7 sets the minimum pulse width of the first analogue channel and RV2 varies the pulse width from that minimum. The same cycle is repeated for the second analogue channel; charging C11 through R1 and then selecting the second discharge resistance, R6 and RV1.

If desired, four more analogue pulse-width modulated channels can be generated by connecting four more variable resistors to pins 1, 18, 17 and 16 but we don't want six analogue channels and also, the LM1871 contains extra circuitry to convert these potential extra channels to two digital channels and at the same time make the receiver much simpler. If pins 1, 18, 17 and 16 are all connected together (as they are here) then for pulses three to six, the same resistor will be used and the last four pulses will have the same length.

Internal logic exists in the LM1871 to operate on information provided on pins 5 and 6 and vary the number of pulses that are sent according to that information. For example, if both pins 5 and 6 are left open (the IC has internal pullup resistors) then only one fixed duration pulse is sent after the two analogue pulses and the rest of the frame time is made up with the synchronising pulse. If both pins 5 and 6 are shorted to ground then a further four fixed duration pulses are sent and the synchronising pulse is proportionally shorter. This is clearly illustrated in Figure 2.

This takes care of the encoding and timing but leaves the problem of the actual transmission. For this purpose the LM1871 provides a single transistor with its emitter internally connected to ground (which removes a few design options but I think they ran out of pins!). As I wanted an oscillator whose frequency was stable but didn't want to spend money on a crystal I chose to use a ceramic resonator as the major frequency selective element. These resonators behave very much like crystals except that they are not quite as accurate or stable and seem to have a whole lot more spurious resonances. In order to control the spurii it is necessary to have the oscillating amplifier selective by itself so that where the spurii occur there is low loop again.

In the circuit chosen, the collector of the oscillator drives a tuned circuit and the power supply and ac earth is connected to a tap almost at the other end of the coil. Thus, the other end of the resonant circuit has a voltage in opposite phase to the collector and of much lower amplitude, suitable to drive the base. The signal to the base is divided down through C6 and C8, together with the ceramic resonator. Thus, the base drive is heavily attenuated for all frequencies except the resonant frequency of the ceramic resonator which controls the frequency of oscillation.

The output from the oscillator is taken from a secondary winding and one end is tied to ac earth via C5. The other side of the winding has a current limiting (and impedance defining) resistor R3, which connects to the +12 volt supply line. Thus, the oscillator signal is coupled at low level to the transmitter supply. R2, C1 and C2 protect the logic circuitry from interference from the transmitter output.

Capacitors C3 and C7 are used to wave shape the data pulses out of the digital section so the RF spectrum of the transmitter output does not "splatter", but this is principally for radio type applications and not strictly necessary here. They are included more for nicety that necessity.

The receiver and data recovery part of the main controller revolves around the National LM1872 which is the companion IC to the LM1871 transmitter. The receiver section of the LM1872 is designed as a superheterodyne receiver, but for this application all that was necessary was a tuned amplifier at 455 kHz with adequate agc as it is indeterminate what attentuation from the transmitter can be expected. For this reason, the local oscillator section of the LM1872 was disabled by grounding its crystal inputs, pins 1 and 2. This makes the mixer of the LM1872 into a simple amplifier (the local oscillator modulates the emitter current of a differential pair and grounding pins 1 and 2 sets a constant emitter current). Thus, what would normally be the RF input becomes an "IF" port and accepts the input from the line.

The actual input signal is coupled in by TR1, a 20:1 step down transformer. The primary is a single turn and the secondary is 20 turns wound around a Philips 3H1 9 mm toroid. This gives a secondary inductance of about 320 μH which resonates with C1, a 390 pF capacitor, at 455 kHz. Thus, the high input impedance as seen at pin 5 of the LM1872 is transformed down by 20^2 to present a few tens of ohms to the 12 volt supply line at 455 kHz and almost no impedance for other frequencies.

The next two stages in the IC provide more than adequate gain for our needs. TR1 couples into the base of one side of a differential pair and TR2 is connected to the collector of the opposite side. The secondary of TR2 couples via diode biassing to the lower section of a cascode pair which is also part of the agc system. TR3 acts as a simple resonator in the collector of the upper transistor of the cascode pair. This collector also drives the agc system and rf detector. Thus, as the agc system has high gain itself, the RF level seen at pin 15 doesn't vary and it is necessary to monitor the dc agc voltage when tuning the receiver.

Once the detector has recovered a binary signal from the RF data bursts the LM1872 must separate the two analogue channels and, by pulse counting, determine the state of the two transmitter switches. The LM1872, like the LM1871, has one master timer which is used to recover frame rate. This is set by R1 and C5. Whenever the LM1872 sees no incoming RF it resets the timer R1C5 and while a continuous carrier is being received the timer is allowed to exponentially rise (see Figure 3).

If the carrier is present for long enough, such as for a synchronising pulse from the LM1871, then a comparator in the LM1872 fires and its decoding cycle is started. The next ON to OFF transition is read as the start of the first analogue pulse and the next ON-to-OFF transition is the end of the first channel pulse and the start of the second. The third transition terminates the second analogue channel pulse and from then on the LM1872 merely counts ON-to-OFF transitions to determine the status of the transmitter switches.

The two digital outputs from the LM1872 are used to drive the cathodes of two optocouplers directly and the anodes are pulsed on zero crossings of the mains. For the two analogue channels the processing necessary is more complicated. The outputs from the IC are set as open collectors and R2 and R3 act as pullups to 5 V. All the timing from the LM1871 is set so that the two analogue channels have pulse widths of between 1 ms and 2 ms (with an allowance for tolerancing — it is less than one and more than two).

As the 75 Hz frame rate gives a pulse repetition rate of 13.33 ms then the two pulse-width modulated outputs have dc components of between 5(1/13.33) and 5(2/13.33) or approximately between 0.4 and 0.8 volts. Superimposed on this is a very strong signal at 75 Hz, plus harmonics. Therefore, the dc component must be dc-shifted and amplified to give an output of between 0 V and +3 V. The two active filters achieve this and provide an attenuation of about 60 dB for the 75 Hz. They are equiripple group delay filters with a phase ripple of 0.5°, which provide an optimum transient and frequency response for this application (see text).

As the dc output is being used to fire triacs, the dc must be related to mains 50 Hz to be of use. IC7, and principally transistors pins 9-10-11, labelled Q1, and pins 12-13-14, labelled Q2, are used as a mains zero cros- ▶

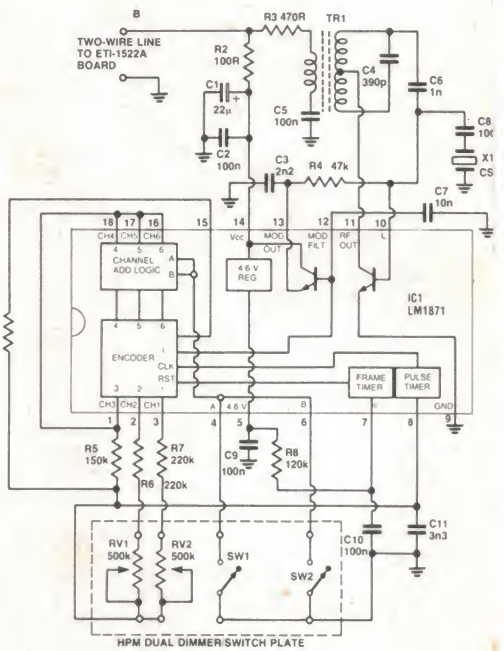
. . . How It Works, continued.

sing detector. The base of Q1 and the emitter of Q2 are both grounded and the emitter of Q1 is connected to the base of Q2 and, via R27 and R28, to the actual 240 volts 50 Hz mains (one of the resistors is connected to the active and the other is connected to neutral so that if active and neutral are reversed, then everything still works). When the mains is at greater than one Vbe above ground Q2 is turned on. Also, when the mains voltage is greater than one Vbe below ground then Q1 is turned on (in fact it must be less than −5 V before Q1 saturates completely). Only for mains voltages between ±0.6 volts are both transistors completely off and their common collectors, pins 11 and 14, at +6 volts. Thus, the two commoned collectors have a positive-going pulse every time the mains voltage passes through zero. This pulse is buffered and cleaned up by two gates in IC6.

The buffered, positive-going pulse is impedance transformed by the rest of the transistors in IC7 acting as a Darlington emitter follower and used to reset a ramp generator formed by Q3 and its associated resistors and capacitors. C18 is forcibly charged to about 2.6 volts through D1 on a mains zero crossing (the other side of C18 is held at 0.7 V by Q3's base). C18 is then charged through R20 and the current is mirrored by collector current through R21. This produces a linear negative-going ramp at the node of C18, D1 and R21. This ramp is applied to the non-inverting inputs of the two analogue channel comparators while the dc signals derived from the filters are applied to the inverting inputs. The two gates of IC6 following the comparators ensure that even when the comparators are always low, which corresponds to lights full on, there is still a pulse on mains zero crossing to fire the triacs. The gate outputs are CR differentiated and buffered, then used to drive the MOC3021 optocoupler input anodes directly.

The four triacs have one terminal connected permanently to the active mains input, the other is connected to the load. This means that when the triacs are off, the driven light fittings are safe. A second, much smaller, triac in the optocoupler is used to trigger the main one on for each circuit. A resistor-capacitor-resistor combination protects the optocoupler triacs from excessively high dV/dt and hence accidental triggering from mains transients. The two triacs that are driven from the dimmer controls have simple LC filters in their outputs to suppress radio frequency interference. The on-off triacs have no need for this as they are always fired on zero crossings.

Circuit of the encoder/transmitter.



opposite direction. The coil used to operate the transistor in the IC provided as an oscillator also gave an easy way of injecting the oscillator output onto the line. Oscillator frequency stability was provided by using a 455 kHz if ceramic resonator (readily available from Tandy, and others) as part of the feedback.

As the LM1871 provides all the necessary circuitry to modulate and waveshape the oscillator output from the encoder output, a complete and compact controller was easy to construct.

The actual controls feeding the LM1871 were made from modified light fitting controls purchased for the purpose. I chose to use HPM light fittings as they have a neat and convenient arrangement where a panel is purchased with the required number of holes as there are to be controls and then the controls (switches or dimmers) are snapped into the panel.

In order to keep things looking exactly like ordinary light fittings I bought two light dimmers and removed all the works from them except the 500k pots, which are the dimmer control elements (see How It Works). The end result can only be destinguished by the two mounting screws for the electronics printed circuit board. In order to save space in the controller all capacitors are the smaller 5 mm pin spacing, 63 V metallised film type which are increasingly becoming an industry standard and are available from many manufacturers.

Once the encoder/transmitter had been designed and modelled, the next problem was to design a modified receiver/decoder which would recover the 455 kHz bursts and regenerate the analogue and digital information. The LM1872 contains all the circuitry for a complete superheterodyne receiver which was somewhat more than was strictly necessary for this application. The on-chip local oscillator was therefore disabled and only the IF amplifier section used. Two of the IF transformers from a set carried by Dick Smith Electronics (L-0260) were used and gave satisfactory performance.

The 455 kHz was coupled from the power supply line with a toroidal transformer whose output was approximately resonated with C1, a 390pF capacitor. This means that the input impedance of the RF section is accurately transformed down to about 20 ohms to recover the 455 kHz from the line. The agc for normal applications is filtered with a 100 nF capacitor on pin 16. In this application, where there is no variation in input signal level, the filter capacitor can be increased to 1 µF, or even grater, with no problems and in fact helps by preventing the agc following the input pulses.

The LM1872 IF and detector sections recover the pulses generated by the LM1871 encoder and pass them onto the decoder section whose operation is shown in Figure 2. It can be seen that the decoder simply counts negative-going edges after the synch pulse to determine the status of the two switches in the LM1871 circuit. The timing diagram also illustrates just how the LM1872 derives timing information from the first two pulses after the synch pulse for the analogue channels.

Figure 3 shows how different numbers of pulses are sent from the LM1871 to convey switch status. As the frame timing in the LM1871 is set by a separate resistor and capacitor from the data RC circuit, as the number of data pulses is reduced the synchronising pulse gets longer so the frame rate remains constant at 75 Hz.

In the decoder circuit used, both the analogue and digital outputs were donfigured as open-collector transistors (the LM1872 offers a choice of open-collector or open-emitter drivers for the digital outputs). Processing of the digital outputs, was no problem and the collectors switched the triac drives directly (see "How It Works").

However, the analogue channels needed a lot of processing before they could be used to operate triac drives. As the whole of the LM1872 had a maximum operating voltage of 7 V the whole of the receiver and triac drive circuitry was operated from a regulated 5 V rail. (I'm sure National had a good reason for the voltage restriction but it escapes me).

When resistors R2 and R3 are connected to the output collectors the resultant output is a pulse-width modulated signal with the pulses swinging between about 40 mV (the transistor V_{ce} sat) and 5 V. This signal has a dc component and a somewhat larger ac signal. In order to recover and amplify the dc, and at the same time remove the ac, several methods were considered but finally the simple and straightforward way was chosen; namely — a low pass filter to preserve and amplify the dc and at the same time provide about 60 dB attenuation of the 75 Hz fundamental (and appropriately more for the higher harmonics of the ac signal).

When it comes to filters there must be about as many different types and class of filter as there are applications; and there are an equally large number of realisations for

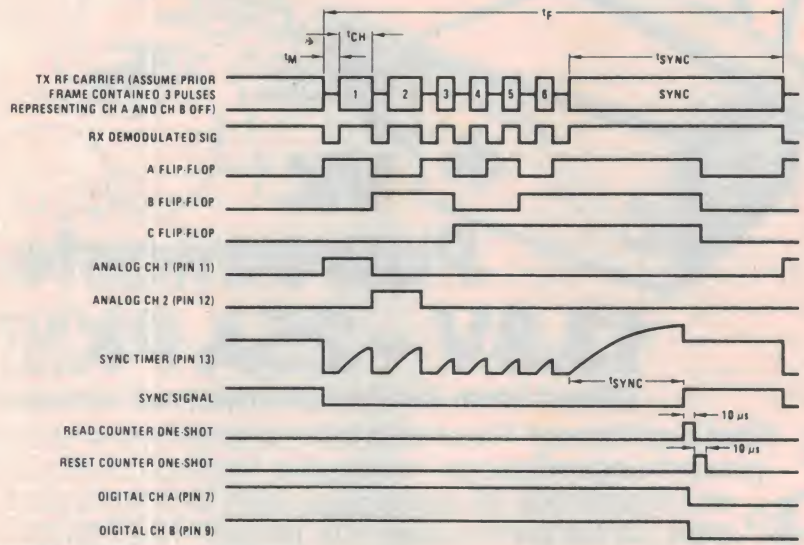
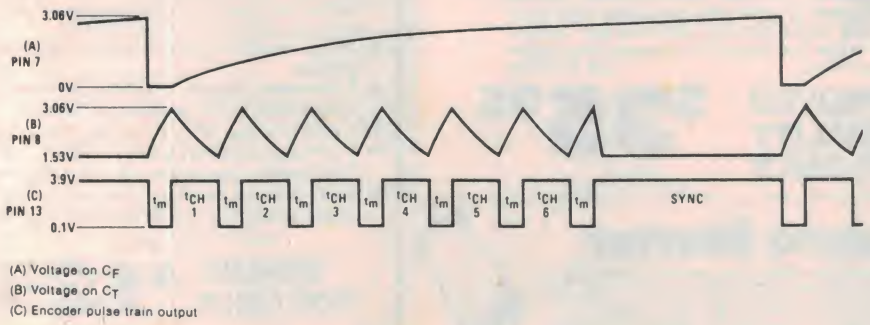


Figure 2(a). Receiver timing waveforms.

LM1871 TX			LM1872 RX		
PIN CONDITIONS		TRANSMITTED WAVEFORM	BINARY PULSE COUNT	DIGITAL OUTPUTS	
PIN 5 (CH A)	PIN 8 (CH B)			CH A	CH B
OPEN	OPEN		100	OFF	OFF
GND	OPEN		101	ON	OFF
OPEN	GND		110	OFF	ON
GND	GND		111	ON	ON

Figure 2(b). Digital channel encoding and decoding via pulse-count modulation.



(A) Voltage on C_F
(B) Voltage on C_T
(C) Encoder pulse train output

Figure 3. Simplified waveforms for the encoder timing circuits.

each class. Filter types vary from *ye olde Butterworthe* (whose chief merit lies in the simplicity and regularity of its transfer polynomial) up to the more exotic *Cauer-Chebychev* filters which give optimum cutoff response but fierce group delay distortion (and hence ring like a bell).

For this application we really need optimum step response, as if the filter rang then, when the lighting intensity was suddenly changed, it would brighten and fade several times before settling down. This would suggest a Bessel filter which has an optimised step response (it doesn't overshoot or ring at all) but a rather slow and soggy frequency response. However, we can do a little better than Bessel's filter by accepting a tiny amount of overshoot (only a few per cent) and using an equi-ripple group delay filter where the filter phase response is allowed to vary a small amount around the ideal linear (Bessel) response and a slight improvement in frequency performance obtained.

The filter actually used is a 5th-order, 0.5° equi-ripple group delay filter which sounds all gosh! gee! wow! fantastic!! but nonetheless actually works just fine. (Linear phase or equi-ripple phase filters also have the advantage that they don't have any very high Q sections and so are a bit more forgiving on component tolerances).

The first section of the filter is a 3rd-order block with the capacitor values shifted to preferred values and the resistor values varied accordingly (this involves fun things like solving a hextic equation (you beat it to death with a calculator!)), but it means you can buy the components in this country. The second section is only a 2nd-order block but it has all the gain necessary to bring the pulse-width modulated dc up to about 0-to-3 volts.

At this stage in the circuit the fact that the information was transmitted at 75 Hz has been removed and all that remains is to relate the dc signals to the mains 50 Hz. In order to do this, IC7, a transistor array, is used to generate pulses on zero crossings of the mains and these pulses are used to generate a ramp which is compared with the dc from the filters (once again, see "How It Works"). After suitable gating to ensure the triac trigger pulses occur when wanted and don't when not (for a pot fully anti-clockwise it is essential that the lights be completely out and when fully clockwise they should be full on — care was taken here with end-limit tolerances) the processed analogue outputs are fed to the triac drives.

All four triacs are triggered through opto-isolators to ensure that all the electronics is safe to work on **but beware!! there is 240 volts on the board!!** The two triacs that are switched from digital outputs have no output filtering as they are triggered on zero crossings, but the two dimmer triacs are filtered to suppress RFI. ●

. . . to be continued, next month.

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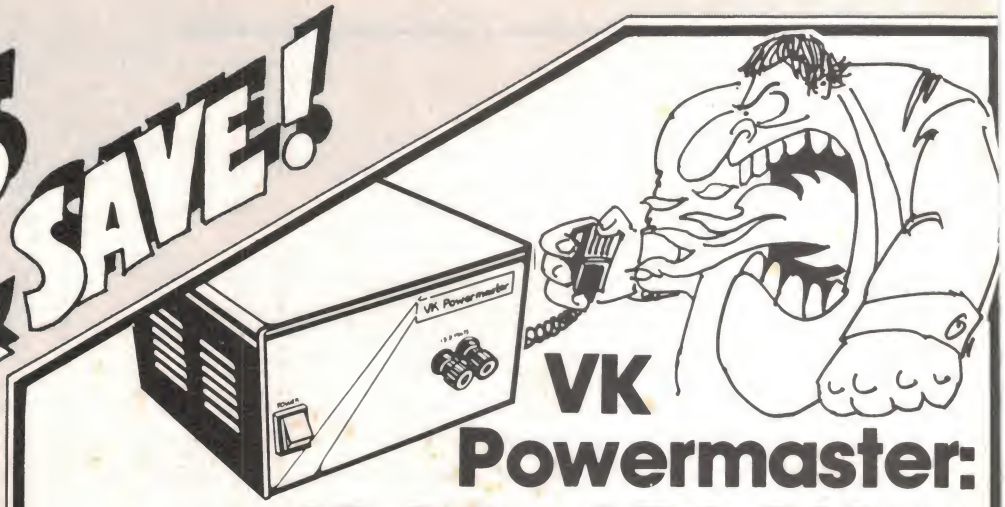

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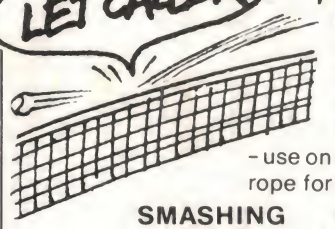

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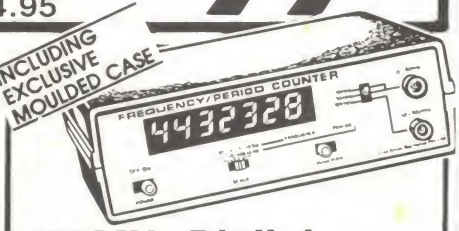

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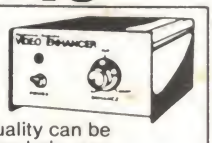

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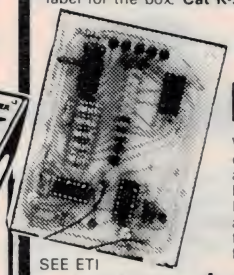

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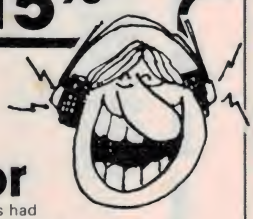

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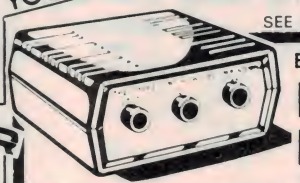

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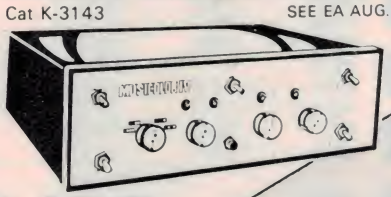

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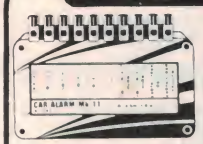

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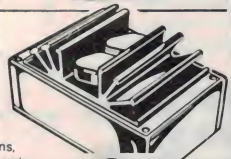

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A678/CT

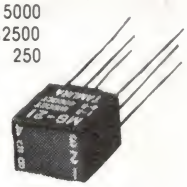
ARLEC TRANSFORMER GUIDE

O.E.M. Enquiries welcomed

Tamura Miniature Pulse

Designed principally for computers and measuring instruments.

Type No.	Primary Inductance (uH)	Details
G 52 J12C	800	Centre tap
G 53 E21C	2500	Centre tap
G 50 J111	8	3 windings
G 51 H111	50	
G 52 E111	250	
G 52 H111	500	
G 52 J111	800	
G 73 H111	5000	
G 74 B111	12500	
G 52 E211	250	



O.E.M. Enquiries welcomed

Tamura Green Chip Series

Miniature transformers designed for transistor circuitry.

Type No	Impedance (Ω) PRI	SEC	Details
MG 24	500	50	AUDIO
MG 22	500CT	600	
MG 25	600CT	12	
MG 21	600CT	600CT	
MG 23	1K	50	
MG17	10K CT	1.5K CT	
MG16	10K CT	2K CT	
MG15	10K CT	10K CT	
MG14	20K CT	1K CT	

Inductance		
MG106	O.I.H.	Inductor

Low Profile

AL 7 VA Series. Insulated to AS 3126. P.C.B. mounting pins compatible with other current models and provision for additional anchorage to PCB's. 240V, 50HZ PRIMARY.

Type No.	VOLTS	SECONDARY AMPS	Details
AL 7VA/30	30	.23	
AL 7VA/24	24	.29	
AL 7VA/18	18	.39	2 equal secondaries for - Series - Centre Tap or Parallel Connection.
AL 7VA/15	15	.47	
AL 7VA/12	12	.58	
AL 7VA/9	9	.78	
AL 7VA/6	6	1.17	

P.C.B. Transformers

250V 50 HZ PRIMARY

Type No.	VOLTS	POWER VA	Details
75000 Series	2-12V	1, 2, 5, 7, 10, 12	2 Secondaries May be used separately or connected in Series or Parallel.

240V, 50 HZ PRIMARY

Low and Extra Low Voltage

Type No.	VOLTS	SECONDARY AMPS	Details
2150	12.6CT	1.25	
2155 A	8.5, 9.5 12.6CT, 15CT	1	
5502	44CT	1.25	
5504	15	2	
5508	12.6CT	2	
5579	6.3	1	
5755	40CT	1.25	
6474	12.6CT	0.15	
6625	25	0.5	
6672 A	17.5, 20, 24CT, 27.5CT 30CT.	1	
6978 A	9, 10.5, 12.6CT, 15CT	2	
7309	12	2.5	
7310	24	1.25	
60817	24	1.25	
5503	11.5, 17	4	
7243	19, 33, 40, 50CT	2	
7311	24	4.2	
9583	10.9, 18.5 × 2	4.7, 0.87 × 2	
60202	17.5, 20, 24CT, 27.5, 30CT	3	
60203	30CT, 40CT 50CT, 60CT	2	Two secondaries can be series or parallel connected.
60291	25.2CT	3.5	

Type No.	VOLTS
60202	2.5, 3, 3.5 4, 5, 5.5, 6 6.5, 7.5, 8 9, 10, 12, 12.5 15, 17.5, 18, 20, 24, 27.5, 30.
60203	5, 10, 15, 20, 25, 30, 45, 50, 55 60
2155 A	1.1, 2, 2.2, 2.4, 3.1, 3.2, 4.1, 5.1, 5.5, 6.3, 6.5, 7.5, 8.5, 8.7, 9.5, 12.6, 15.
6978 A	1.2, 1.5, 2.1 2.4, 2.7, 3, 3.6, 4.2, 4.5, 5.1, 6, 6.3, 7.5, 8.7, 9, 10.5, 12.6, 15.
6672	2.5, 3, 3.5, 4, 5, 5.5, 6, 6.5, 7.5, 8, 9, 10, 12, 12.5, 15, 17.5, 18, 20, 24, 27.5, 30.

Thyristor (SCR) Trigger Transformer

For power supplies, lamp dimmers, motor speed controls.

Type No.	VOLTS
XT1185	415 (Max voltage between windings)

ARLEC

HEAD OFFICE VICTORIA
30-32 Lexton Road, Box Hill, Vic., 3128
Ph (03) 840 1222 Telex 32286

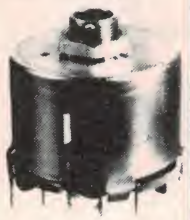
NEW SOUTH WALES
47 Drummond St., Belmore, N.S.W. 2192 Ph (02) 789 6733 Telex 22874

WAGGA
K. J. Warden (Agencies) Pty. Ltd.
7 Norton Street, Wagga, N.S.W., 2650
Ph (069) 21 2735 Telex 69960

Multi Tap

General purpose transformers for special projects and experimental work provide a wide choice of output voltages. 240V, 50HZ PRIMARY.

SECONDARY AMPS	Details
3	Centre tapped 5V, 24V, 30V.
2 Amp Series 4 Amp parallel	Centre tapped 10, 20, 30, 40, 50 and 60V.
1	Centre tapped 2, 12.6 and 15V.
2	Centre tapped 3, 12.6, and 15V.
1	Centre tapped 5, 24 and 30V.



SECONDARY Max. SCR AMPS
70

Enclosed Stepdown Transformers

240V, 50 HZ PRIMARY

Ideal for garden lamps, pond lights and water pumps, automatic trouble lamps, safety lights, pool lighting etc.

Type No.	VOLTS	SECONDARY AMPS	Details
60269	32	2.25	Type No. 60280, 60426, and 60480 have two fuses in the secondary output for pool lighting applications.
60279	32	7.8	
60280	32	5.9	
60425	24	3	
60426	24	7.9	
60453	12	6	
60480	12	15	

Portable Stepdown Transformers

Type No.	VOLTS	SECONDARY AMPS	Details
PT 5578	115	0.35	For shavers, radios, tape recorders, heating blankets, TV receivers appliances and instruments. 2 Pin socket
PT 2164	115	0.87	
PT 2166	115	2.17	
PT 2168	115	4.35	
PT 2170	115	8.7	
PT 9585	240	1	For T.V. servicing, electronic workshops etc. 3 Pin socket
PT 9789	240	2	

Constant Voltage

Isolated, constant RMS Voltage output.

Type No.	INPUT	OUTPUT
CV 9024	190-260 RMS	240V-1A
CV 9027	190-260 RMS	240V-4.17A

Audio

Type No.	PRIMARY IMPEDANCE	POWER	Details
45012	70.100V Line 4.8.16 ohm	1/8-4 WATTS	Line to speaker impedance
45035	600 ohm	odbm	PCB Mounting. Telecom approved
45065	600 ohm		
LT 347	600 ohm; 600 ohm,	- 20 dbm	Line isolation to Telecom 1053, 1054

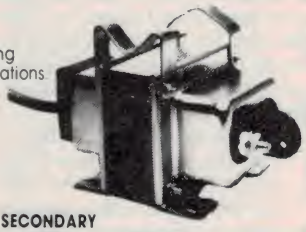
Control Circuit

For switchboards. PRIMARY 240V 50 HZ. Insulation to AS 3126.

Type No.	IMPEDANCE	SECONDARY POWER	Details
PT 9169	32.24	1.88	SEC approved
PT 9170	32.24	3.12	
PT 9171	32.24	6.25	

Soldering Iron

For low voltage soldering irons or similar applications. PRIMARY 240V 50 HZ



Type No.	VOLTS	SECONDARY AMPS	Details
60158	3.3	30 Int	SEC approved

Bell and Chime Transformer

PRIMARY 240V, 50 HZ.

Type No.	VOLTS	SECONDARY AMPS	Details
60999	Choice of 5, 8, 12, and 16 Volts	1	Specially designed to power door bells and chimes. Double insulated and short circuit protected

A.C.T.
K. J. Warden (Agencies) Pty Ltd
24 Geelong St., Fyshwick, A.C.T., 2609
Ph. (062) 80 5519 Telex 62475

SOUTH AUSTRALIA
30 Beulah Rd., Norwood, S.A., 506-
Ph. (08) 42 8918 Telex 89234

QUEENSLAND
Cnr. Vernon Terrace & Ethel St.,
Newstead, Qld., 4006 Ph. (07) 52 1131
Telex 43263

WESTERN AUSTRALIA
611 Hay St., Jolimont, W.A., 6014
Ph. (09) 381 9834, 381 9522
Telex 93973

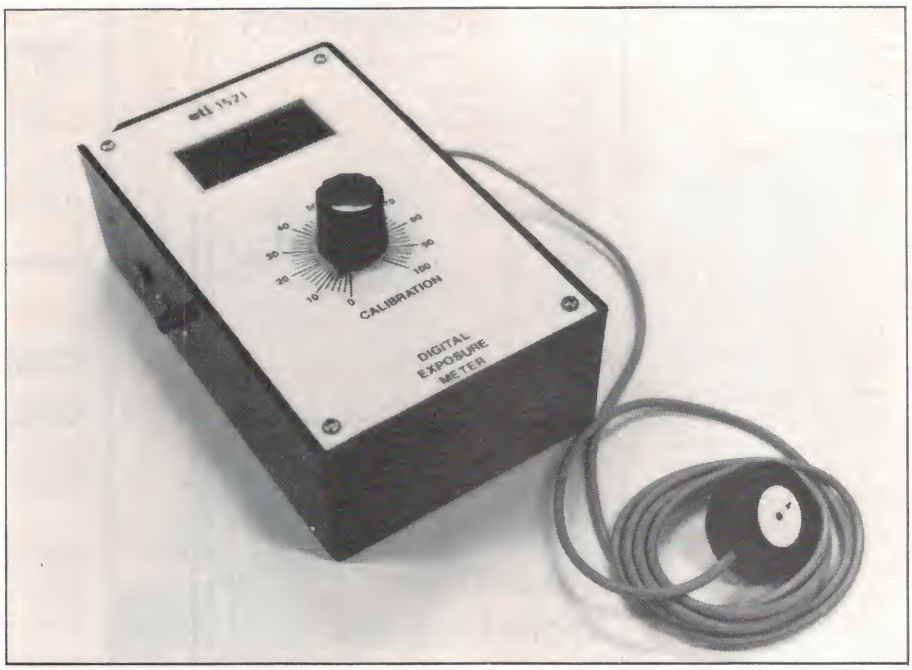
TASMANIA
Launceston GHE Electronics
76 York St., Launceston, Tasmania,
7250 Ph. (003) 31 6533

Hobart GHE Electronics
162 Argyle St., Hobart, Tasmania, 7000
Ph. (002) 34 2233

An enlarging exposure meter with digital readout

Peter Ihnat

With this project you'll get a higher yield of decent exposures from your darkroom. It includes a sensor that compensates for 'cosine error'.



NUMEROUS photographers develop their own films and prints in anything from well-equipped darkrooms to bathrooms and laundries made light-tight with blanket-covered windows. Rapidly rising costs of 'commercial' production, coupled with the fact that the photographer has complete control over the finished product, are some of the reasons for photographers "rolling their own". Fortunately, there is a surprisingly small number of electronic gadgets necessary in the darkroom to produce good quality black and white and colour prints. Even so, darkroom oriented projects in electronic magazines are few and far between.

One electronic gadget which is a must in the darkroom is an exposure meter — a device which quickly and accurately indicates exposure time and ends up paying for itself in terms of time and photographic paper saved. The current project evolved when I decided to buy a commercial exposure meter and soon realised a digital one could be built for the same cost as a simple commercial "two-LED comparative" type.

The device described here is very simple to operate since it consists of a remote probe (light detector), three-digit display (which indicates exposure time in seconds) and a "calibration" control on the front panel. One simply puts the sensor on the brightest area of the enlarger baseboard and the meter will indicate the correct exposure time. But more of this later. Let's look at the design details and construction.

Circuit description

The basic idea behind the unit's operation is to produce a digital output inversely proportional to the intensity of light falling on a sensor. Why inversely proportional, you might ask? Well, for a given type of photographic paper, the light intensity times the required exposure time is a constant (which takes into account the speed of the paper and the spectral "colour" of the enlarging lamp). Mathematically:

$$I \times E = C \qquad [i]$$

where I = light intensity, E = exposure time and C = a constant.

Since we need the output from the meter to be E, the equation can be rearranged as follows:

$$E = C/I \qquad [ii]$$

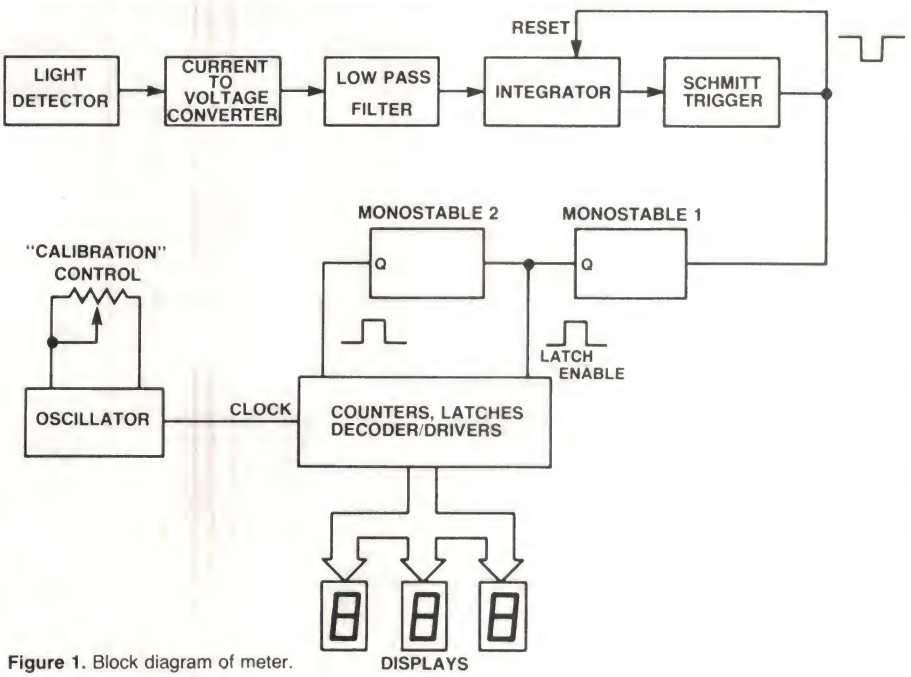
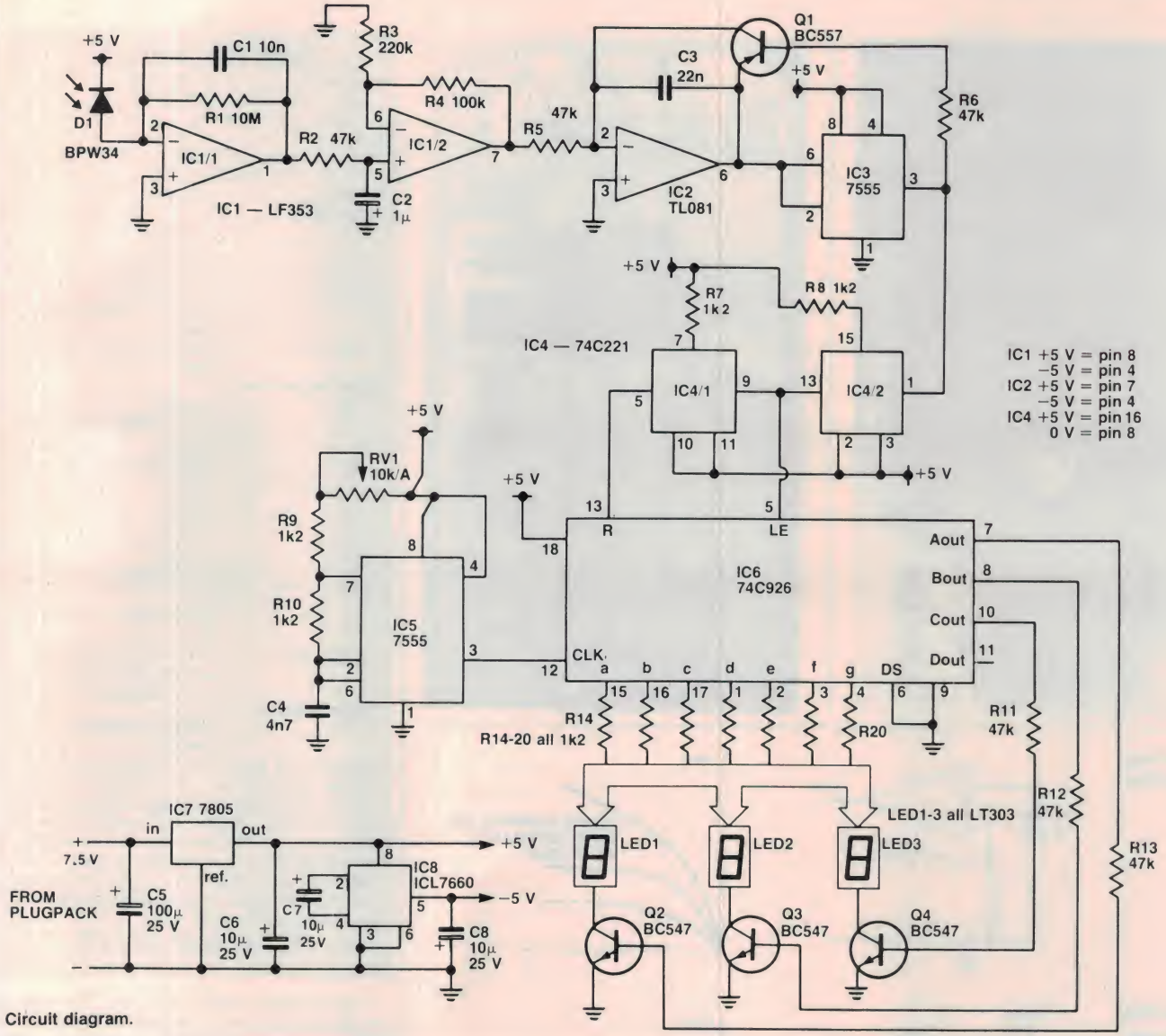


Figure 1. Block diagram of meter.

Notice that the exposure is *inversely* proportional to light intensity — the more light you have the less exposure is necessary. How is C handled by this meter? It's the "calibration" control on the front panel!

Figure 1 shows the block diagram of the meter. Originally, I used a phototransistor as the light sensor and it worked well at high light levels. Unfortunately, at the low light levels typically encountered in darkrooms (0.001 — 10 foot candelas) the response was highly non-linear. The alternative was to use a photodiode as a light-to-current converter — the current then being ▶



Circuit diagram.

HOW IT WORKS

The meter simply provides gating pulses whose period is inversely proportional to the intensity of the incident light. The pulses gate counts for a master oscillator into a four-digit counter which then displays the reading obtained.

Light falling on photodiode D1 produces a proportional current which is converted to a negative voltage by op-amp IC1/1. Resistor R1 affects the sensitivity and C1 is used to filter out any stray ac signals (HF and LF) picked up by the remote probe and connecting cable. IC1/2 is set up as a low pass filter with a gain of approximately 1.5 (= R4/(R3 + 1) and a cutoff frequency of approximately 3 Hz (= 1/(2.R2C2)). A first order filter is sufficient here since at 100 Hz the gain is approximately five octaves by −6 dB/octave = −30 dB.

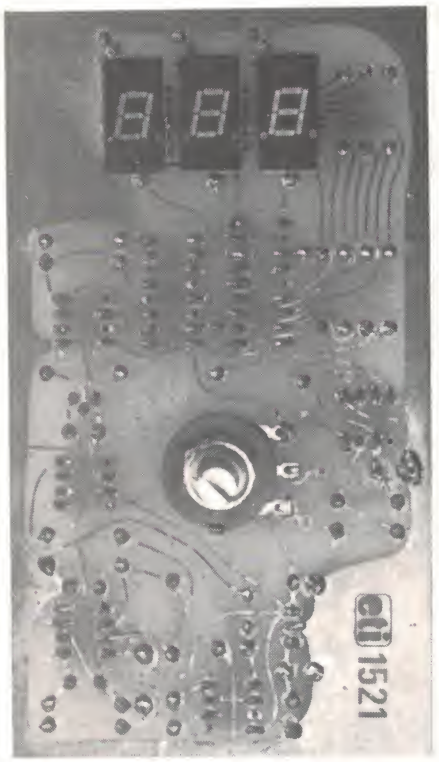
IC2 and IC3 together form a voltage-to-frequency converter. IC3 is a 7555 timer set up as a Schmitt trigger with trigger levels set at 1/3 and 2/3 of the supply, i.e: 1.6 V and 3.3 V. IC2 is connected as an integrator and Q1 is used as a resetting switch. Operation is as follows — assume Q1 is initially off. A constant negative voltage applied to the input of the integrator causes the output voltage to increase linearly while charging C3.

When the output voltage exceeds the upper trigger level of the Schmitt (3.3 V), it's output goes LOW which switches on Q1, discharging the integrator capacitor. The output of the integrator falls until it equals the Schmitt's lower trigger level (1.6 V). This sets the Schmitt's output HIGH again switching off Q1, allowing the cycle to repeat. The length of the cycle is inversely proportional to the magnitude of the voltage applied to the integrator.

The integrator reset pulse (from the Schmitt trigger) is used to trigger monostable IC4/2 which in turn triggers monostable IC4/1. The two respective outputs put active-high pulses on the latch enable (LE) and reset (R) inputs of the counter IC6 (refer to Figure 3 for relevant timing information) to latch the current count and reset the counter. IC6 is basically a four-digit counter with latches, decoders and multiplexer (to drive four displays) all in the one package. This has the advantage of low component count and low power dissipation.

Note that resistors R14-R20 control the brightness of the displays and can be varied to suit. The least significant digit of the counter seems not to be used but is actually used as a divide-by-ten stage to reduce jitter in the final display. IC5 is the master oscillator whose frequency is controlled by RV1. It is a typical astable oscillator based on the 7555 timer.

Power for the meter is derived from a 7.5 V plugpack. The positive supply (+5 V) is produced by a 7805 voltage regulator. Since a split supply is required for the op-amps. I used the Intersil ICL7660 CMOS voltage converter to produce −5 V directly from the +5 V supply. This IC, plus two other components (C7 and C8), produce a very simple and effective negative supply generator. Refer to ETI July 1982, page 51 for a technical description of the IC.



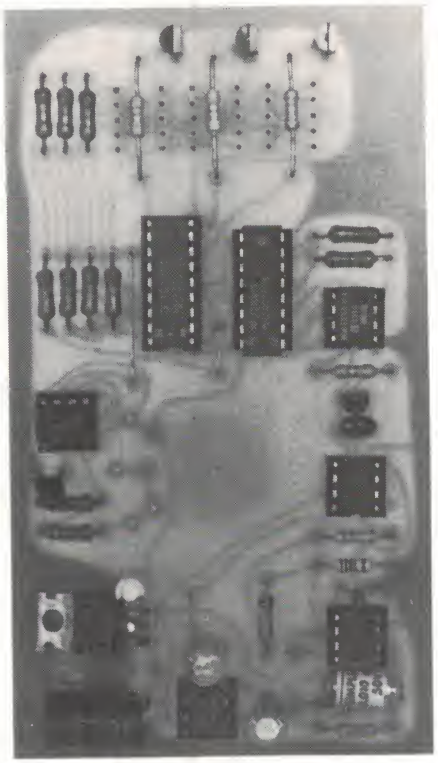
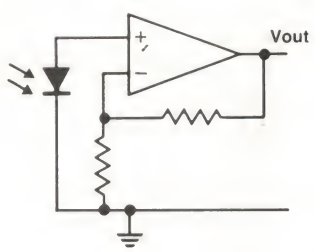


Figure 2(a). Photovoltaic mode.



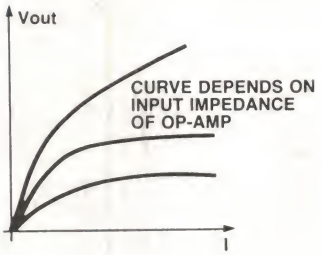
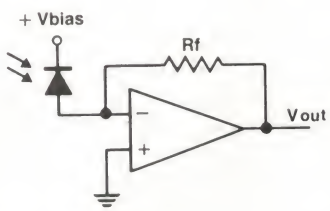
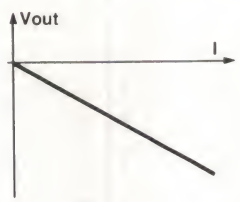
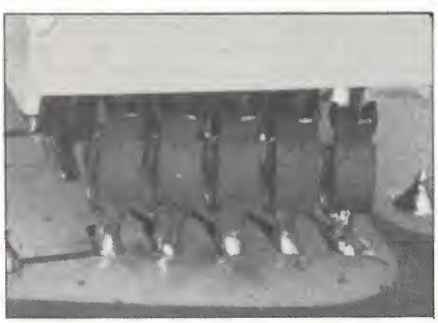


Figure 2(b). Photocurrent method.







The trickiest part of the construction is the mounting of the molex pins which hold the 7-segment display on the copper side of the pc board.

converted into a voltage by an appropriate op-amp circuit. Figure 2 shows two possible methods.

The photovoltaic mode shown in Figure 2(a) unfortunately has a logarithmic transfer characteristic so I used the photocurrent method (Figure 2(b)) which has a very linear response. The diode I used is the BPW34 which is commonly available. Unfortunately, photodiodes which cover the same spectral range as the eye are difficult to obtain in Australia. The BPW34 has it's peak response at 850 nanometres wavelength which is well in the red but since all enlargers use incandescent lamps of some description, no problems arise.

PARTS LIST — ETI-1521

Resistors.....all ¼W, 5%
R1.....10M, 10%
R2, 5, 6, 11, 12, 13.....47k
R3.....220k
R4.....100k
R7, 8, 9, 10, 14-20.....1k2
RV1.....10k/A see text

Capacitors
C1.....10n poly
C2.....1µ/10 V tant.
C3.....22n greencap
C4.....4n7 greencap
C5.....100µ/25 V electro. radial leads
C6, 7, 8.....10µ/25 V electro. radial leads

Semiconductors
D1.....BPW34
IC1.....TL082, TL072, LF353 or sim.
IC2.....TL081, TL071 or sim.
IC3, IC5.....7555
IC4.....74C221
IC6.....74C926
IC7.....7805, LM340T/5
IC8.....ICL7660
Q1.....BC557, BC558, BC559 or sim.
Q2, 3, 4.....BC547, BC548, BC549 or sim.
LED1, 2, 3.....LT303, HP5082-7740 or sim. common-cathode 7-seg, displays

Miscellaneous
SW1.....DPDT slide switch (optional)

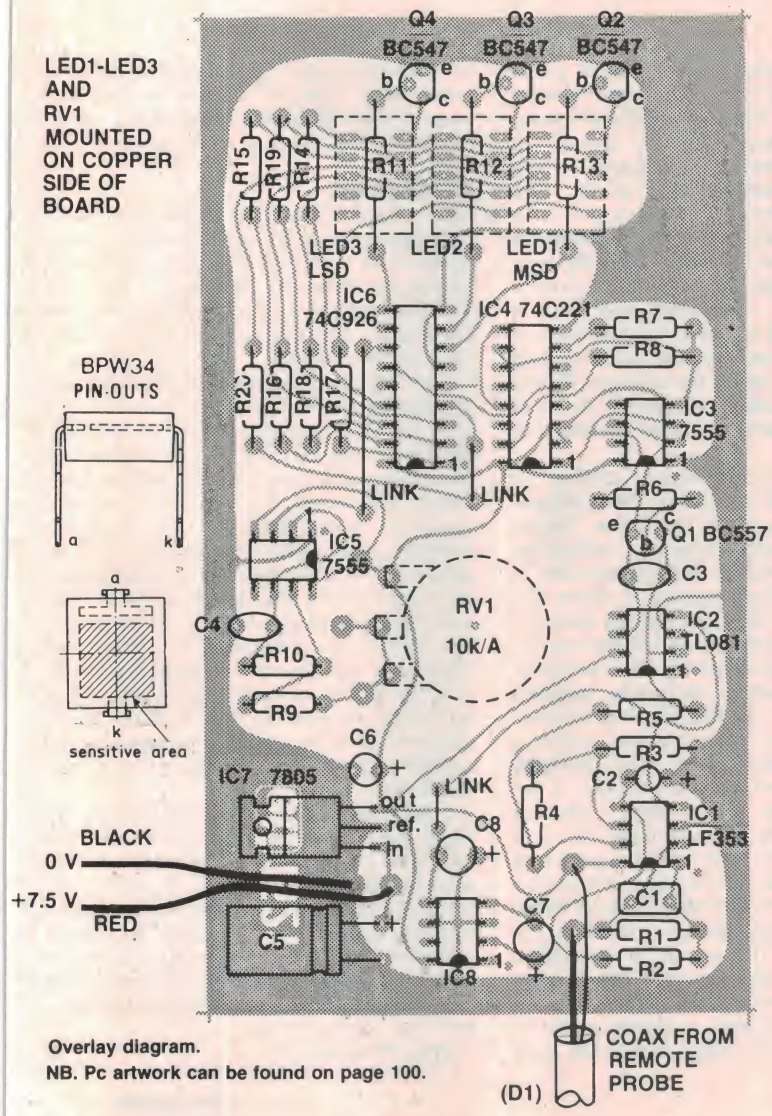
ETI-1521 pc board; dc plugpack with 7.5 V output (e.g: DSE cat. no. M-9526 or similar); coaxial socket to suit plugpack connector; zippy box 158 x 95 x 50 mm; half metre length of single core shielded cable; 35 mm film container; strip of 50 Molex pins; 30 x 60 mm piece of red filter; 5 x 8-pin IC sockets; 1 x 16-pin IC socket; 1 x 18-pin IC socket; hookup wire; Scotchal front panel label; nuts & bolts, etc.

Price estimate: $65-$73

The output voltage from the first stage is proportional to the intensity of the incident light but unless you have an enlarger which operates from a dc power supply, this voltage will have a significant 100 Hz ac component. The signal is then passed through a low pass filter to remove the ac and finally feeds the input of an integrator — a voltage-to-frequency converter. But since we need a signal which is inversely proportional to the light intensity, I have used the period of the waveform produced to gate the output of a master oscillator into the digital counter. The master oscillator essentially runs at some constant frequency which is set by the "calibration" control. The overall timing diagram shown in Figure 3.

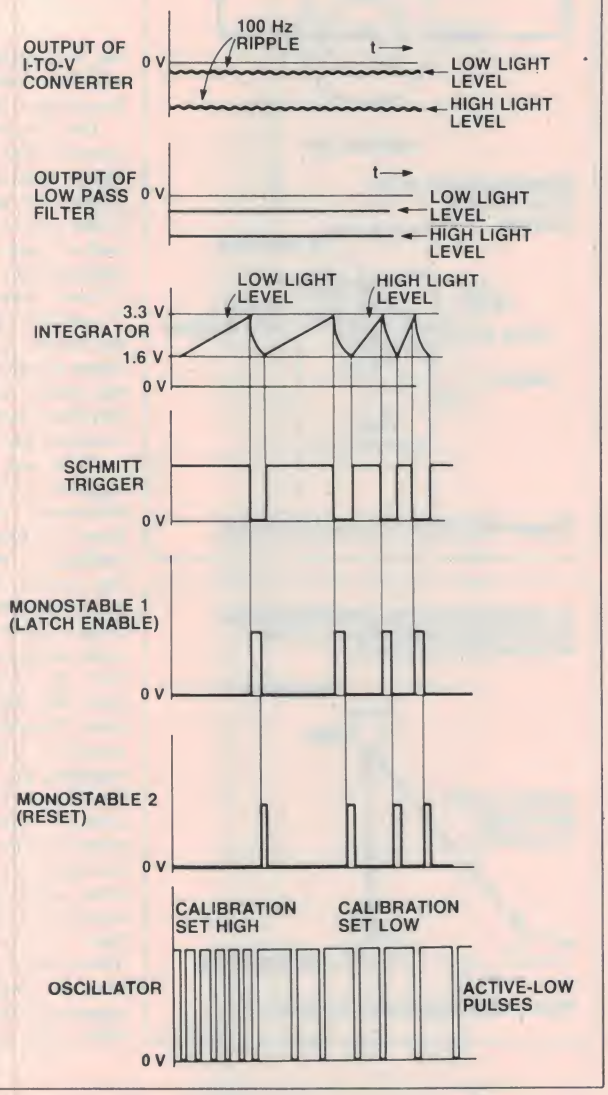
Construction

If the project is assembled on the pc board I designed for it, then there should be little trouble with construction. A close visual inspection of the pc board should be done before assembly to see there are no cracks in tracks or bridges between tracks or pads. See that all the holes are correctly drilled. Firstly, insert and solder the three wire



Overlay diagram.
NB. Pc artwork can be found on page 100.

Figure 3. Overall timing diagram.



links, then the resistors (except R11-R13) and capacitors. It is recommended that IC sockets be used and these should be soldered in next followed by the 7805 voltage regulator, IC7.

The trickiest part of the construction is the mounting of the molex pins which hold the 7-segment displays. Note that these and the calibration potentiometer are mounted on the *copper side* of the pc board. The tracks around the 7-segment display area are very close together and so great care must be taken to avoid solder bridges between tracks or even worse, overheating the tracks causing them to lift. The following procedure should only be attempted with a fine-to-medium tipped iron.

Firstly, break the molex strip into six strips of five pins each. Using emery paper or steel wool, clean the oxide coating off the part which will be soldered. I noticed while constructing the prototype that any rubbish on these pins caused a weak solder joint to be produced and several pins came loose when I attempted to insert the displays. These loose pins are extremely hard to replace without producing solder bridges and so the extra time spent cleaning saves problems later on.

When cleaned, a strip of five pins can then be inserted until the ends just show through the reverse (component) side of the board. The pins should be soldered before continuing with the other strips (if all six are inserted first, it will be almost impossible to solder them). The connecting bridges can then be carefully removed.

The remaining resistors and the transistors can now be mounted along with RV1. As mentioned before, RV1 is mounted on the copper side of the board and since the completed pc board "hangs off it", a drop of Araldite can be used to hold the two together with greater reliability.

Talking about reliability, a normal carbon pot can be used for RV1 but since these get dusty and end up with "dead" spots, I recommend a cermet, or conductive plastic type, such as the ones made by Bourns. If these are hard to get hold of I have made provision on the board for mounting the standard type. At this stage, the board can be powered up and the supply voltages checked. If all is OK, the ICs and displays can be inserted ensuring that they are all orientated correctly. To aid insertion, the pins on the 7-segment displays should first be straightened with long nose pliers.

Now on to the mechanics. The prototype was mounted in a 158 x 95 x 50 mm zippy box. The pc board itself is mounted on the lid of the box by means of RV1. I used two nuts on the pot shaft — one below and the other above the lid to position the board at a suitable distance from the lid. The artwork for the Scotchal front panel is reproduced elsewhere in this article. I mounted the on/off switch (optional) and power socket (to suit a plug pack) on the left side of the unit.

Remote probe

The BPW34 photo diode can be mounted in any convenient container to act as a remote probe, e.g: a pill box lid. Note that this container should not be very high since you need to measure the light intensity as close as possible to the base board of your enlarger where the photographic paper will sit. A 50 mm high container may not make much difference to your reading when mak- ▶

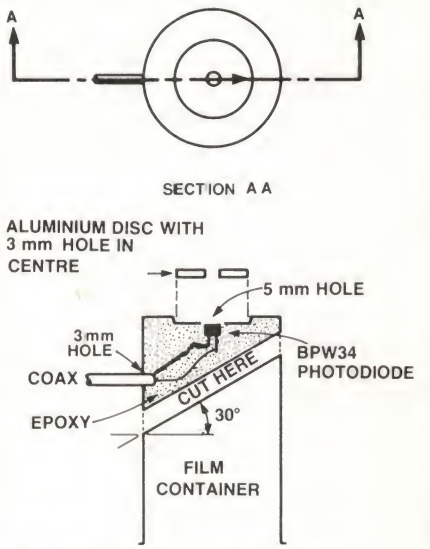


Figure 4(a). Details of probe construction.

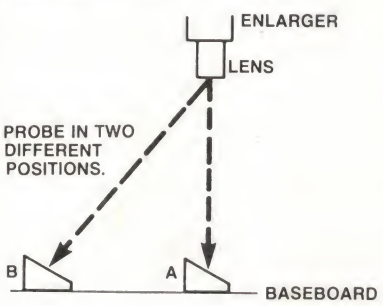


Figure 4(b). 'Cosine error' correction.

ing big enlargements, but for small prints when the lens may be only 100 mm from the baseboard, there will be a significant error.

For the prototype I cut the end off an unused film container (you know — the black plastic container that 35 mm film comes in) and drilled two holes in it — a 5 mm one in the top to hold the photo diode and a 3 mm one in the side to pass the coax through (see Figure 4(a)). On top I glued a 17 mm diameter aluminium disc with a 3 mm hole drilled in it to let light through to the diode. I painted the disc white to help when positioning under the enlarger. Filling the probe with epoxy completes it's construction and results in a very durable and compact unit.

Note also that the probe is tilted at an angle of 30° to the horizontal. This is to provide some "cosine error" correction. Cosine error is most easily observed when the enlarger is switched on without any film in the carrier. If a light reading is taken directly beneath the lens and another near the edge of the baseboard, there will be a significant difference between the two. In actual fact, the two readings should be identical since the idea of an enlarger is to provide even illumination over the entire area of a negative. The error exists since the light reaching the sensor when at the edge of the baseboard hits it at an angle, whereas directly below the lens the light rays are perpendicular to it. Any sensor experiences a drop in sensitivity as the angle of the incident radiation increases (with respect to the vertical). One easy way of correcting for this is to angle the sensor permanently. Then, when readings are taken beneath the lens, the angled sensor has slightly reduced sensitivity and will give a reading equal to that taken near the edges where the light falls directly onto it (see Figure 4(b)). For consistency, I placed an arrow on the probe and orientate it to point towards the centre of the baseboard when taking all readings.

Operation

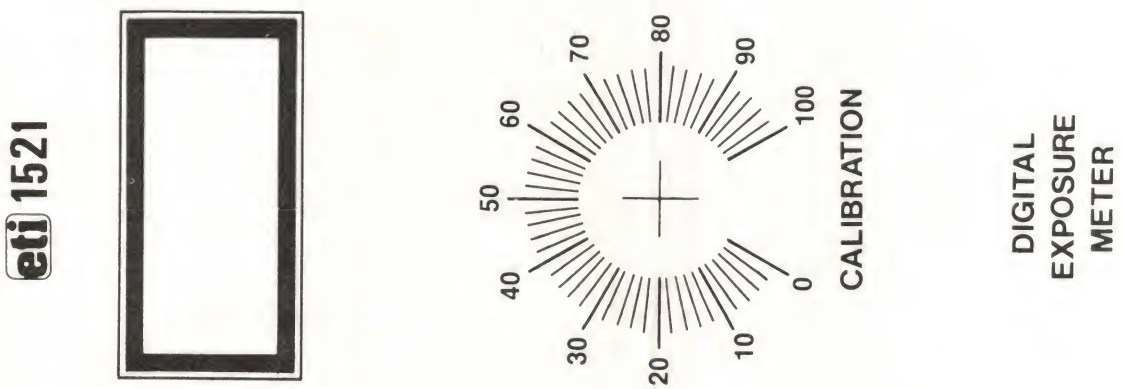
The unit itself is very easy to use and needs only one control, the "calibration" control, to be set for each type of paper you use, e.g: Ilfospeed, Bromide, Ektaprint 2 etc. The idea is initially to prepare a test strip of your "standard" negative or slide to determine the correct exposure.

Let's assume for Ilfospeed grade 3 paper you find that 12 seconds is the correct exposure for your negative. Without changing the lens f-stop or enlarger height, position the probe on the *brightest* area of the baseboard and adjust the calibration control until the meter reads 12. The exposure meter is now calibrated for this type of paper and the reading from the dial should be written on the outside of it's packet. The next time you produce prints on this paper you simply set the meter to the setting previously determined, position the probe on the brightest area of the projected image and adjust the lens aperture until the meter gives a reasonable reading, say between five and 60 seconds. Then expose for the indicated time.

Note that a test strip is only necessary when *initially* setting up the unit and not each time it is used. Also, since the meter is used to measure the intensity of the brightest area of the negative, this corresponds to allowing sufficient light through the lightest area of the negative to *just* produce black on the paper in this area. The other shades of darkening will then fall in line to produce a correctly exposed print.

Happy exposing!! ●

Front panel artwork.



The printed circuit board pattern is on page 103.

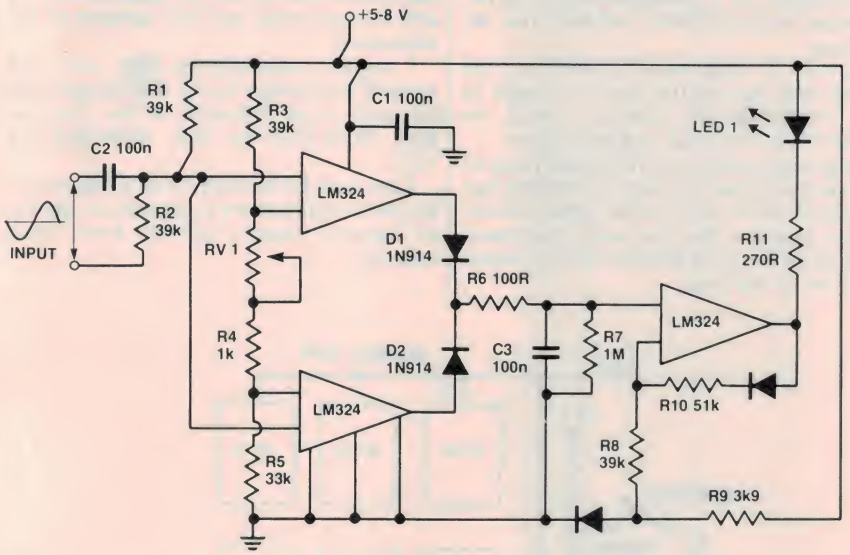
These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we cannot enter into any correspondence about any of the circuits, nor can we produce constructional details.

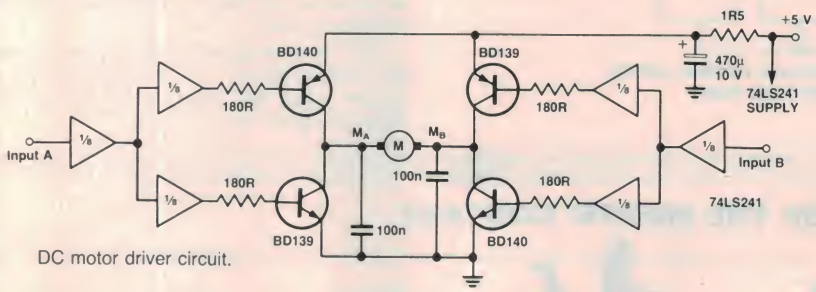
Peak level indicator

David Hamill of **The Gap, Queensland** designed this peak level indicator which is useful for recording when it is more important to know what the peak level of a signal is, rather than its average level.

VU meters are normally used for this purpose, however, you will find that the LED output of this circuit is easier to interpret and makes the recording more accurate as the distortion will be reduced.

IC1a gauges the positive peaks while IC1b does the same for the negative peaks. Both positive and negative are set by RV1. You can select any threshold from ±1 V. Whenever the input exceeds the positive of the negative level LED1 lights for about 0.1 second.





DC motor driver circuit.

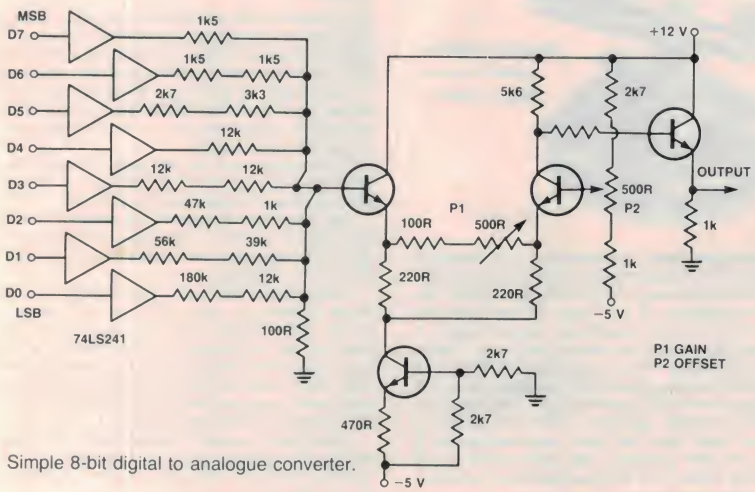
Input A	Input B	M_A	M_B	Result
0	0	+5V	+5 V	no operation
0	1	+5 V	GND	motor turns
1	0	GND	+5 V	motor turns opposite
1	1	GND	GND	no operation

Two circuits for the 74LS241

Brian O'Conner of **Box Hill Victoria,** has come up with two circuits for use with microprocessor parts. Both of them use the 74LS241 and in each case pin 1 is tied to ground and pin 19 to Vcc.

The first circuit is for a dc motor driver suitable for use with 400 mA/6 V motors like Fisher Technic. Little or no heatsink is required as all transistors are either saturated or off.

The second circuit is for a very simple 8-bit digital to analogue converter which can be built from scrap box components. It will give a linear output of 8 V p-p and the ramp produced by an 8-bit increment is quite smooth.



Simple 8-bit digital to analogue converter.

IDEA OF THE MONTH

Microbee write-protected memory ★☆★

Paul Leonardi, Canley Vale NSW

After having inadvertently written over my source code or BASIC program with an untried program, I decided to put a copy of the program in a switch-selectable write-protected area of RAM, and then run the program.

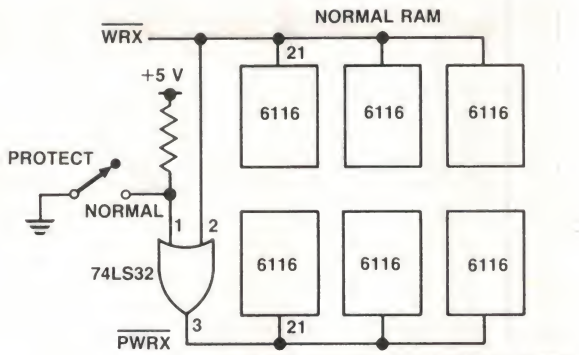
So then if things went haywire and the source code was written over, the copy in the write-protected memory could be copied back, corrected and tried again.

To protect a 6116 the WRX line must be disconnected (pin 21) and the PWRX line connected to it. Be careful when disconnecting one line that you don't disconnect other 6116s as the WXR line is often linked from one to the next.

In the Microbee the first and last 2K blocks (6116s) should not be protected; the first is used for a BASIC-EDASM scratch pad and the last for BASIC strings and variable storage (16K and 32K versions of the Microbee).

I suggest protecting the fifth, sixth and seventh RAM chips on the 16K version, and the ninth to the fifteenth on the 32K version. (2000-37FF for 16K, 4000-77FF for 32K).

Care must be exercised with a cold start if the protected memory is selected, as the top of memory pointer will be lower than expected.



SWITCH SELECTABLE NORMAL/WRITE PROTECTED RAM

Scope for electronics in heaven

The Scope/ETI 'Idea of the Month' contest was won by Ian Johnston in November, 1983. Ian is now the Minister for the Mornington Parish of The Uniting Church. However, before joining the Ministry he studied electronics and holds a Diploma of Electrical Engineering.

Ian, who designed a tone operated switch for ETI's 'Ideas for Experimenters', is shown using his prize, a Scope Panavise Multi-Purpose Work Centre.

'PRIZE WORTH $90!'

'IDEA OF THE MONTH' CONTEST

COUPON

Cut and send to: **Scope/ETI 'Idea of the Month' Contest, ETI Magazine, P.O. Box 227, Waterloo NSW 2017.**

"I agree to the above terms and grant *Electronics Today International* all rights to publish my idea in ETI Magazine or other publications produced by it. I declare that the attached idea is my own original material, that it has not previously been published and that its publication does not violate any other copyright.*"

* Breach of copyright is now a criminal offence.

Title of idea .....

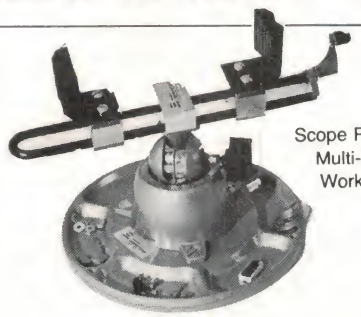
Signature .....

Name .....

Date .....

Address .....

..... **Postcode** .....



Scope Panavise Multi-Purpose Work Centre.

Scope Laboratories, which manufactures and distributes soldering irons and accessory tools, is sponsoring this contest with a prize given away every month for the best item submitted for publication in the 'Ideas for Experimenters' column — one of the most consistently popular features in ETI Magazine. Each month, we will be giving away a Scope Panavise Multi-Purpose Work Centre, Model 376/300/312, comprising a self-centering head (376), standard base (300) and tray base mount (312), all worth about $90! Selections will be made at the sole discretion of the editorial staff of ETI Magazine. Apart from the prize, each winner will be paid $10 for the item published. You must submit original ideas of circuits which have not previously been published. You may send as many entries as you wish.

RULES

This contest is open to all persons normally resident in Australia, with the exception of members of the staff of Scope Laboratories, The Federal Publishing Company Pty Limited, ESN, The Litho Centre and/or associated companies.

Closing date for each issue is the last day of the month. Entries received within seven days of that date will be accepted if postmarked prior to and including the date of the last day of the month.

The winning entry will be judged by the Editor of ETI Magazine, whose decision will be final. No correspondence can be entered into regarding the decision.

The winner will be advised by telegram the same day the result is declared. The name of the winner, together with the winning idea, will be published in the next possible issue of ETI Magazine.

Contestants must enter their names and addresses where indicated on each entry form. Photostats or clearly written copies will be accepted but if sending copies you must cut out and include with each entry the month and page number from the bottom of the page of the contest. In other words, you can send in multiple entries but you will need extra copies of the magazine so that you send an original page number with each entry.

This contest is invalid in states where local laws prohibit entries. Entrants must sign the declaration on the coupon that they have read the above rules and agree to abide by their conditions.

SHOPAROUND

ETI-1521 digital exposure meter

It's a long time since we did a photographic-type project, so this should please and surprise all the photo-hobbyists who read ETI. If you have any photo-hobbyist friends, show them this project — they might be interested.

Components for this project are all commonly available items, with the exception of the cermet calibration pot — but a little digging will get you one. Jaycar had some ('manufacturer's surplus') recently. The 74C926 counter is readily available from many suppliers. The Intersil ICM7225 can also be used. The Intersil ICL7660 supply rail inverter is imported by R&D Electronics and **All Electronic Components** of 118 Lonsdale St, Melbourne act as their retail distributor.

Kits will likely be supplied by **Rod Irving Electronics** in Melbourne and maybe **All Electronic Components**. You could also enquire from **Altronics** in Perth.

Film of the printed circuit and front panel artwork is obtainable from ETI-1521 Artwork, ETI Magazine, P.O. Box 227, Waterloo NSW 2017. Positive or negative film costs $3.50 each for the pc board or front panel art, post paid ($7.00 the pair).

ETI-678 Microbee ROM reader

This project will be carried in kit form by those firms giving hardware support to the Microbee. Try **Altronics** in Perth, **Jaycar** and **Avtek** in Sydney, **Rod Irving Electronics** and **Magraths** in Melbourne. You might also try **All Electronic Components.**

If you're making your own pc board and want positive or negative film, you can obtain what you want for just $1.60 post paid from ETI-678 Artwork, ETI Magazine, P.O. Box 227, Waterloo NSW 2017. Make sure you ask for positive or negative film, according to what your photoresist requires.

PCB outlets

Alf Capas of **Better PC Boards** in Bass Hill, Sydney (02)645-1241, has advised us that you can now purchase ETI project pc boards, made by him, through **Sheridan Electronics** in Redfern and **Geoff Wood Electronics** in Rozelle.

Printed circuit boards

Almost every pc board (and most front panels) ever published by ETI may be obtained from:

All Electronic Components
118 Lonsdale St
Melbourne Vic 3000

For pc boards produced in recent years, the following suppliers either keep stocks on hand or can supply to order:

Jemal Products
P.O. Box 168
Victoria Park WA 6100

Jaetronics
58 Appian Drive
St Albans Vic 3021

Better PC Boards
112 Robertson Rd
Bass Hill NSW 2197
(02)645-1241

RCS Radio
651 Forest Rd
Bexley NSW 2207

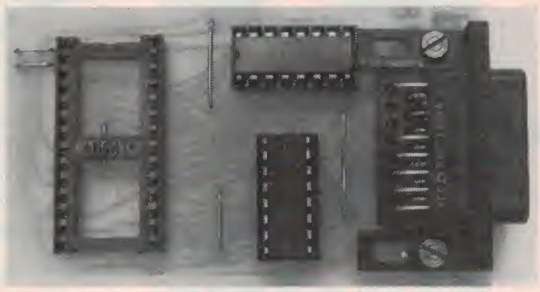
Mini Tech
P.O. Box 9194
Auckland N.Z.

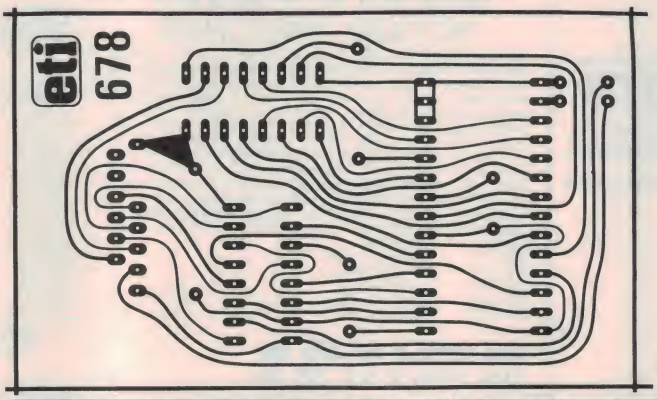
The following retailers generally keep stocks on-hand of pc boards from recent years' ETIs:

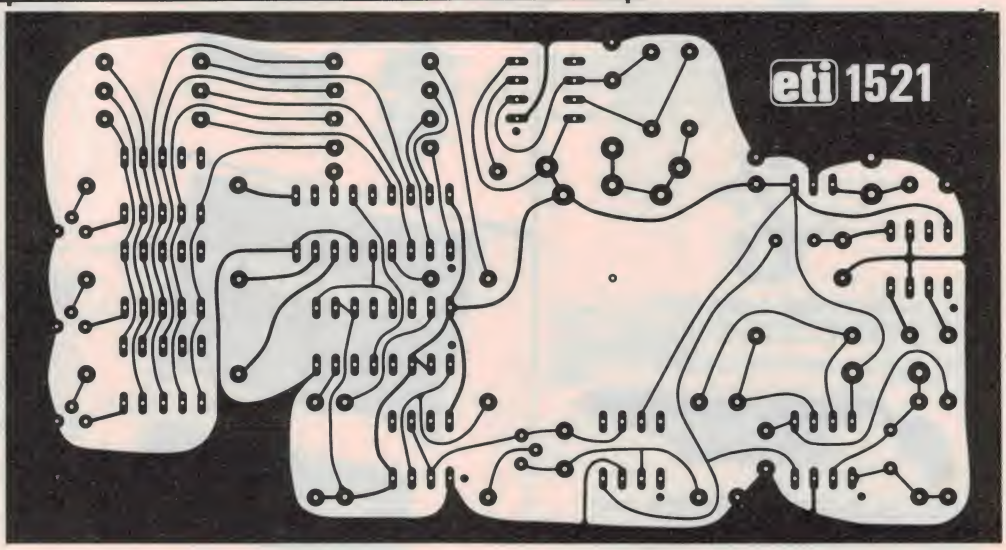
Rod Irving Electronics
425 High St
Northcote Vic 3070

Billco Electronics
Shop 2, 31 Pultney St
Dandenong Vic 2175

Jaycar
117 York St
Sydney NSW 2000







GREAT NEW PRODUCTS

60-KEY COMPUTER KEYBOARD

- AS USED IN THE FAMOUS MICROBEE
- SPST CONTACTS
- FRAME MOUNTED - QUALITY UNIT

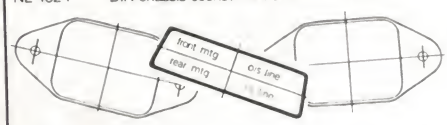
Cat XE-3522

ONLY $29.95

WHAT ARE STICKIES?

As you can see, "stickies" are stick-on templates. Attach the template to a panel (note the crosshairs for accurate alignment) and proceed to cut out a perfect hole! The plastic film also protects the panel from scratches while you are working on it.
Stickies are available for the common irregular hole cutouts i.e. Cannon DB-25, XL series chassis plug and socket and IEC-320 chassis (mains) plug.

Cat. No.	DESCRIPTION	Price
NL-4010	25 way 'D' template - Pkt of 6	$1.95
NL-4014	XLR-31 series template - Pkt of 6	$1.95
NL-4018	XLR-32 series template - Pkt of 6	$1.95
NL-4020	IEC 320 chassis plug - Pkt of 6	$1.95
NL-4024	DIN chassis socket - Pkt of 6	$1.95



MINI BREADBOARD

Just the right thing for many small projects. This board has the same features as our larger breadboards but measures a compact 80 x 60mm. It has 420 holes. Perfect for the occasional project.
Cat. PB-8808

ONLY $6.95

DID YOU MISS OUT?

Jaycar's brand new 1984 Catalogue appeared as an insert in this magazine. If it has gone it has been stolen! If you want one (or another one) simply send $1.00 for postage to the address below.

MICROBEE KITS

ETI 733 RTTY CONVERTOR. Ref: ETI April 1983
This simple project allows you to hook-up your MicroBee to a HF receiver and print radio teletype messages on a monitor screen. Listen to the world news FREE!!
Cat. KE-4654 ..... **ONLY $17.95**

ETI 668 MICROBEE EPROM PROGRAMMER Ref: ETI February 1983
This simple, low cost EPROM programmer just plugs into the Bee's I/O port and enables you to save programs in any of 5 different common EPROMs available (2716, 2532, 2732, 2732A, 2764). Kit comes complete with 'Personality' plug and all IC sockets.
Cat. KE-4650 ..... **$39.95**

ETI 649 MICROBEE LIGHT PEN Ref: ETI Aug '83
This simple, low cost device plugs into the Bee's 8 bit port. The "pen" gives you an entry into the world of light pens and interactive software.
Cat. KE-4656 ..... **SHORTFORM $19.50**
SPECIAL PROBE CASE TO SUIT (as specified in ETI article)
Cat. HB-6400 ..... **$19.95**

PARALLEL INTERFACE KIT FOR THE MICROBEE
Includes 15 pin 'D' plug - add $15 if Centronics plug required.
Cat. KE-7017 ..... **$15.00**

SEALED PCB MOUNT ROTARY SWITCHES

We have decided to discontinue our range of open "skeleton" switches for these. The new switches have contacts enclosed in a fully molded plastic housing - reminiscent of European design rotanes. The silver plated contacts are terminated with PCB pins instead of the usual eyelet. You can solder to the pin, of course, but the pin also inserts straight into the PCB. Another feature of the switch is its programability. A removable ring with tab can be inserted into the switch several ways to yor particular requirements. For example, if you purchase a 1 x pole 12 way (max.) switch you could convert it to, say, 1 pole 7 way between stops. Versatile! Naturally the switches feature $^{3}/_{8}$x32 TPI bush mount and a ¼" shaft with standard flat. The shaft is hard nylon moulded to help reduce signal capacitance problems. They are almost the same price as the inferior wafer units.

Cat. No.	Description
SR-1210	1 pole x 12 way
SR-1212	2 pole x 6 way
SR-1214	3 pole x 4 way
SR-1216	4 pole x 3 way
SR-1218	6 pole x 2 way

1-9 ONLY $1.95 ea
10« ONLY $1.75 ea

'TRADE PACKS OF SCREWS & NUTS etc.

By popular demand. Now you can get commonly used hardware in bulk and save a fortune!

Cat. No.	DESCRIPTION	Price
HE-0736	Rubber feet stick-on 12mm Pkt. 100	$9.60
HE-0738	Rubber feet stick-on 20mm Pkt 100	$11.50
HE-0913	TO-3 Mica insulator kit Pkt 100	$12.50
HE-0922	TO-220 Mica insulator kit Pkt 100	$9.80
HP-2742	6BA Flat washer Pkt 500	$6.95
HP-2752	4BA Flat washer Pkt 500	$6.95
HS-1521	6BAx½" Cheesehead screw Pkt 500	$7.50
HS-1522	4BAx¼" Cheesehead screw Pkt 500	$5.95
HS-1527	4BAx½" Cheesehead screw Pkt 500	$6.95
HP-2712	6BA Hex nut brass Pkt 500	$12.50
HP-2722	4BA Hex nut brass Pkt 500	$12.50
HS-1607	No.4x¼" Self tappers Pkt 500	$4.50
HS-1609	No.4x½" Self tapper Pkt 500	$5.50

TECHNICIANS LIGHT PROBE

This N.Z. made unit enables you to place a spot of bright light in the most awkward places. Ideal for servicemen or kit assemblers. A flashlight or lamp always seems to cast a shadow where you need to see!! The exclusive design allows you to "poke light" around corners!! The unit is solidly made (Aluminium) and takes two penlight cells. A two function switch (lock-on and press-on) is also a feature.
Cat. TH-1838

ONLY $12.95

WILDCARDS II

This book is the sequel to Wildcards Vol.1. It contains much, much more information and a memory map of 7 pages. If you liked the first volume you're going to love the second even more.
Cat. XE-8016 ..... $16.00

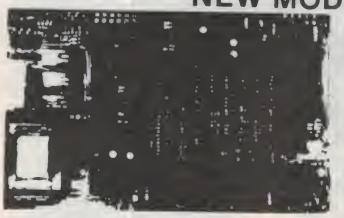
ETI644A

See ETI Jan '83!!

DIRECT CONNECT MODEM

Ref: ETI October 1982

NEW MODEL



Two models (i) Short form which contains ALL PCB components as specified by ETI (BEWARE!!). The genuine ETI PCB with plated-thru holes, solder mask and component overlay is supplied. We also supply at NO EXTRA CHARGE a full set of quality IC sockets. A must with plated-thru PCB - remember this when making comparisons.
(ii) Full kit. Includes : all of the above plus 12V plug-pack, case, switch and LED bezel and Cannon DB-25 RS-232 connector. Makes a complete stand-alone modem. ● Capable of a range of Answer/Originate operating modes ● Selectable Baud rate ● Software controlled ● Uses new patented technique ● More reliable and faster than most acoustic modems.
Arlec transformer as used in this project only $22.00

SHORTFORM KIT	COMPLETE KIT
Cat. KE-4600	Cat. KE-4601
ONLY $169	**ONLY $199**

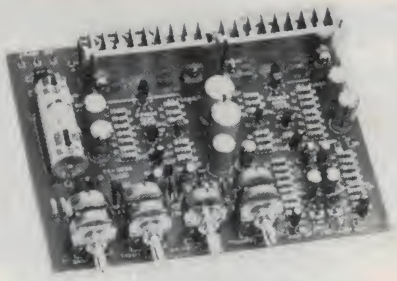
LESS FEBRUARY SPECIAL DISCOUNT OF 10%

30W « 30W Stereo pre-amp STEREO AMPLIFIER

- Fully built and tested
- Separate bass, treble, balance and volume controls
- Less than 0.1% distortion
- Mic, phono and aux. inputs (line)
- Power supply components on board

Back at last! No hassle amplifiers. Just connect a transformer, speakers, a signal and you're away!

ONLY $34.95



SYNTOM

Original design from the U.K. magazine "Electronics and Music Maker" April 1981. Self-contained unit produces a variety of fixed and falling pitch effects. Trigger by tapping the unit itself or by striking the drum to which the unit is attached. The Jaycar "SYNTOM" comes complete with high quality pre-drilled moulded all ABS box 152 x 80 x 47mm with professional silk-screened front panel.
FEATURES: Decay from less than 0.1 second to several seconds, pitch control, sweep control and volume on/off.
Cat. KJ-6502

ONLY $36.50

INFRA RED DIMMER KIT

$25.95

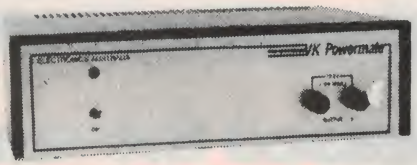
Ref: EA January 1984
Now you can dim or turn off the lights from the comfort of your armchair!
Short form kit contains all parts for I.R. kit. Note this must be used with a Jaycar KA-1509 Touch Sensitive Dimmer ($19.95)
Cat. KA-1530

DIGITAL DELAY LINE KIT

The Digital Delay Line is designed to produce a huge variety of electronic effects. It works very well but the amazing thing is the low, low price! The effects depend on the time delay selected and some of those included are: Phasing, Flanging, Chorous, ADT (Automatic Double Tracking), Echo, and Vibrato. The delay time can be varied from 0.32ms to 1.6 seconds! Because the signal is stored in digital form there is, unlike analog systems, no degeneration of the signal with time and unlimited repetition is provided by use of the freeze control.
All the controls mount directly upon PCB's to eliminate wiring and to further simplify construction the main board is 'plated-thru' i.e. there are no wire links or link-thru pins. The whole of the memory whether for the basic 400ms machine or the fully expanded 1.6 second model all fits on the main board. The cabinet which is free standing but also suitable for 19" rack mounting, is fully finished to a very high standard. The panel is deep blue whilst the cover is sprayed with a durable black enamel. The kit is available for only $449 - compare with inferior units that can cost over $2,000!!
Cat. KJ-6621

COMPLETE 400MS VERSION ONLY

$449



VK POWERMATE NEW MODEL

ONLY $89.95

Ref: EA December 1982
Get up to 13.8V @ 10 amps to run those mobile rigs at home! The Jaycar kit is complete.

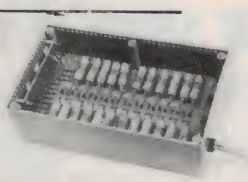
IONISER KITS

COMPLETE KIT

- High efficiency emitter head - Fits completely inside a high quality ABS box (NOT a metal lid) - Only 2-core mains flex protrudes from the box - You can pay over $80 for a built-up inferior unit!

Cat. KJ-6511

ONLY $45



SHORTFORM KIT

- runs directly from 240V mains
- low power consumption
- produces high intensity electric field
- output around 7.5kV
- will not necessarily produce ozone in standard form
- ideal for those who wish to 'try' an ioniser at an economical price.

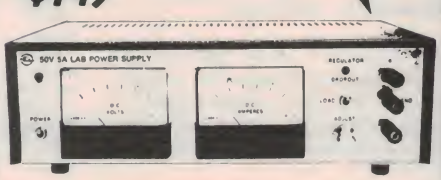
ONLY $24.50

Cat. KJ-6510

50V/5A LABORATORY POWER SUPPLY

Ref: EA May/June 1983
Cat. KE-1520

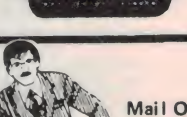
$149



CENTRONICS PLUG 36 WAY

Cat. PP-2420

$14.95



Jaycar

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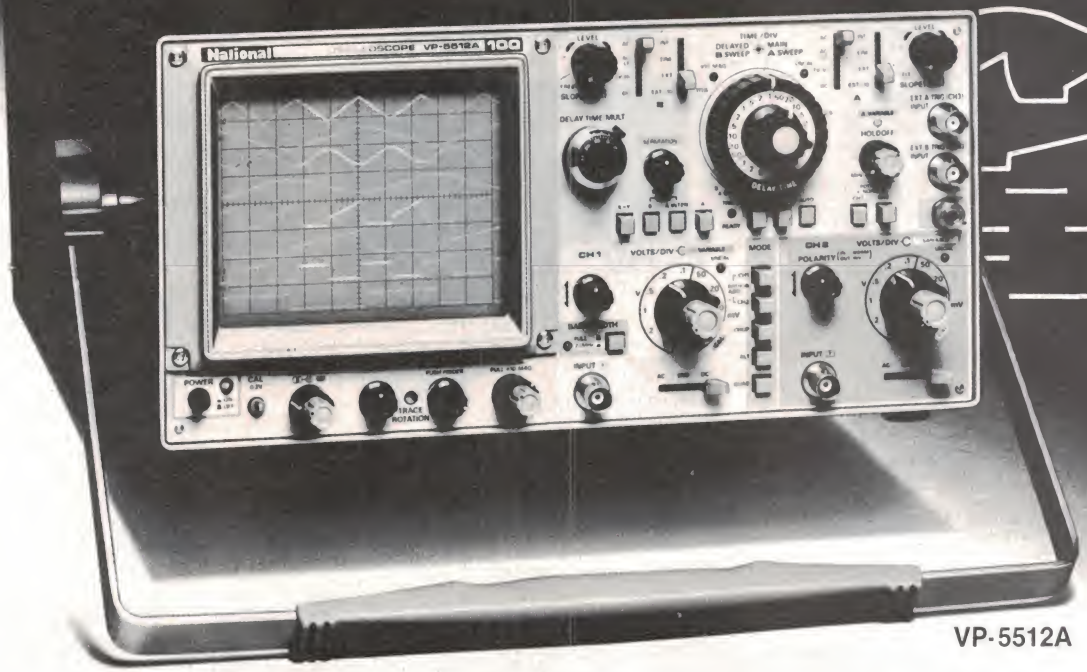

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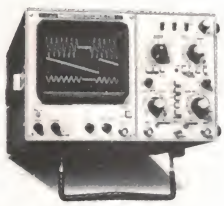

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MELBOURNE READER WINS SCANNER CONTEST

David Paxton of North Ringwood, an outer Melbourne suburb, won the SX-200 Scanner Contest featured in the October issue last year. He correctly answered the five questions and wrote what was judged to be the best 'essay' on what features of the SX-200 attracted him.

David is 22 years old and works as a Technical Officer with Telecom. He was delighted to receive the prize as he said he'd never won anything before!

The picture shows David (standing) accepting his prize, an SX-200, from Greg Whiter, proprietor of GFS Electronic Imports, who kindly donated the prize.

On his entry form, David said, "The SX-200's versatile scan and squelch modes, extensive frequency coverage, FM and AM detection and simple operation are features guaranteed to make scanning a pleasure".

David says his interests are computers and, recently, ham radio. He said scanning is a new interest which is the reason why he entered the contest.

For those still puzzling over the five questions, here are the answers.

The world's first radio patent was applied for by **Guglielmo Marconi** in **June**, 1896. The first 'radio' apparatus installed by the British Wireless Telegraph and Signal Co. was installed in the **Kaiser Wilhelm der Grosse**. Martin, Barton and Fargo did not invent the transitor, it was **Shockley, Bardeen and Brattain**. Australia's WT Act was passed into law in **1905**.

Thanks to the hundreds of enthusiastic contestants who made the contest such a success. Keep your eyes peeled for another exciting contest.

RF & COMMUNICATIONS SOFTWARE DESIGN

Technical Imports has released three 'design kit' software packages for the analysis and optimization of RF performance, PLL characteristics and communication-circuit design.

Each design kit comprises several computer programs for electrical engineering applications, available and tested on both the Tektronix 4050 Series of graphics desktop computers and the HP 9800, 200 and 9000 Series.

Each package contains program functions for universal mathematical function plot and frequency selection for minimum IMD products in mixers.

The RF design kit contains a program for optimization of noise figure or intercept point of cascaded amplifiers, mixers and filters. The PLL design kit has a program for optimization of type-2, 2nd, 3rd and 5th-order loops and one for general analysis of PLL circuits.

The communications design kit includes program functions for complex impedance of electrically short antennas, digital filter design and antenna spray patterns with driven elements.

The kits are intended to give the designer a better understanding of circuit functions and produces computed results of circuit analysis and optimization in the form of tables and graphical plots.

Prices start from around $2000 per kit, with individual programs available for less than $1000.

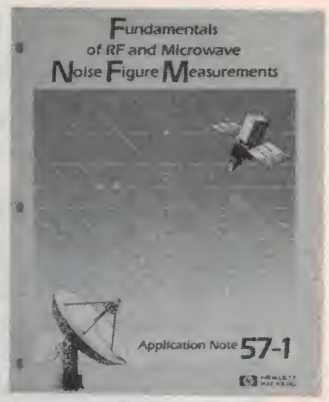
For further information, contact **Technical Imports Australia, P.O. Box 176, Crows Nest NSW 2065. (02)922-6833.**

NOISE FIGURE MEASUREMENTS

Hewlett-Packard's new application note AN/57-1 *Principles of RF & Microwave Noise Figure Measurement* is now available for all those working on device, component, subsystem and system noise figure. It replaces the long-popular AN/57, *Noise Figure Primer.*

The 40-page note serves as a comprehensive tutorial on noise figure for the neophyte engineer with detailed material on thermal and shot noise, concepts of noise figure, effective noise temperature, Y-factor, etc.

The experienced engineer also will find plenty of useful information on subtle measurement considerations including single-sideband vs double-sideband, effects of local oscillator noise, second-stage effects and corrections, hot/cold techniques, frequency conversion and image considerations.



An extensive glossary includes common symbols and detailed technical explanations of most terms. Also included is a bibliography of 34 other noise-figure related references. AN/57-1 (Pub. No. 5952-8255) is available at Hewlett-Packard sales offices free of charge.

ECONOMICAL UNIVERSAL COUNTER

Hewlett-Packard's new HP 5334A universal counter, priced less than $4000, offers new performance and measurement capabilities for a counter in this price class, says the company.

A major feature is that it allows users to measure frequency, period, rise time, fall time, pulse width and peak-to-peak volts — all the fundamental waveform parameters — automatically, at the touch of a button.

Auto trigger and auto attenuation further simplify measurements, while internal storage of up to 10 complete front-panel setups speeds and simplifies operation.

HP-IB, included as standard equipment, allows automatic operation with a computer or other instrumentation.

Key instrument features include two-channel, 100-MHz capability; 9-digits-per-second resolution; two nanosecond, single-shot time inteval and keyboard-selectable gate times in millisecond increments, from one millisecond to 99.99 seconds.

In addition to performing the standard counter measurements of frequency and time interval, the HP 5334A includes period, ratio and totalise measurements plus external arming capabilities. Options include a high-stability oven oscillator, a 1000 V floating DVM and a 1.3-GHz C channel.

Full details available from your local Hewlett-Packard office.

MICROWAVE PHASE NOISE

Hewlett Packard's Product Note 11729B-1, 'Phase Noise Characterization of Microwave Oscillators (Phase Detector Method)', presents an overview of the importance of phase noise in microwave devices and systems and compares several common measuring techniques with emphasis on the phase-detector method.

The note describes specific operational features of the HP 11729B carrier-noise test set for measurements on sources from 5 MHz to 18 GHz. The HP 11729B turns a relatively complex and subtle measurement procedure into a high-confidence routine exhibiting a noise floor of −123 dBc/Hz at a 10 kHz offset in X-band.

Specific topics include: multiplier chains, downconversion considerations, various phase-lock methods, system calibration and correction, accuracy considerations, loop noise suppression, and the use of the HP 11729B in fully automated test systems.

Five technical appendices expand on earlier material and a 10-reference bibliography is given. Product Note 11729B-1 (Publication 5952-8286) is available free of charge from **Hewlett-Packard** sales offices.

WOMAN AMATEUR OPERATOR HONOURED BY CLUB

Evelyn Bahr, has been honoured with Life Membership of the Townsville Amateur Radio Club in recognition of "her outstanding services to amateur radio".

Evelyn Bahr (VK4EQ) obtained her Amateur Operator's licence in the mid-1950s and then went on to become the first-ever female member of the Townsville Amateur Radio Club. She has remained an active participant in Club activities ever since.

One of her first official positions was as Club Treasurer during 1974. She became co-editor of the Club magazine 'Backscatter' in March 1975, but soon took over full editorial responsibility and has continued in the position until the present day.

She has been net co-ordinator for the Club station VK4WIT for the Sunday evening news broadcasts throughout North Queensland for a number of years and also participates in the activities of the Wireless Institute Civil Emergency Network.

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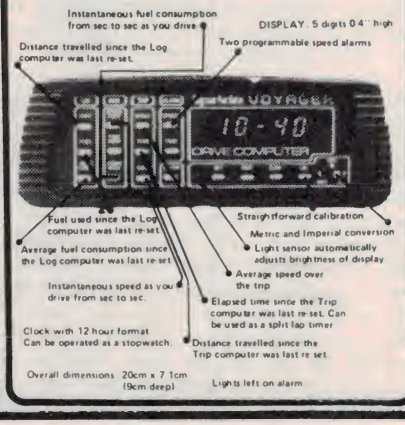


Transequatorial VHF propagation and equatorial plasma bubbles

Massive depleted zones in the equatorial ionosphere, stretching in field-aligned interhemispherical arcs, have been observed experimentally in recent years. Theoretical explanations of the gross features have been put forward. This paper argues the case for collecting a further round of experimental data and outlines a low-cost way of using VHF trans-equatorial propagation, available to radio amateurs, to study behaviour patterns of individual equatorial plasma bubbles.

M. L. Heron
Physics Department, James Cook University of North Queensland, Australia

1976 WAS A YEAR of good vintage for equatorial aeronomy. It brought with it the first reports of so-called equatorial plasma bubbles, and with them the basis of the new way of thinking about irregularities in the equatorial ionosphere. The classic account was given by Ron Woodman and Cesar La Hoz (1), where they present records showing rising plume-like structures in the equatorial ionosphere recorded on the 50 MHz radar at Jicamarca in Peru. The radar, operating in the conventional mode of power return from a range-gate, receives echoes from ionospheric irregularities having a scale size of three metres. A sketch of one of their records is shown in Figure 1 where the vertical axis has been converted from pulse time-delay into height. The horizontal axis is more complicated. It is like the photo-finish record at the Cluden racecourse (Qld), where the film moves past a slit at the expected speed of galloping horses. Here the moving record assumes that the ionospheric plasma is galloping eastwards at 125 metres/second, which is about average for the early evening. On this basis a conversion from a distance of 450 km gives a time lapse of one hour. The plume structures are therefore drifting eastwards at more or less 125 m/s and they rise to higher altitudes as time progresses.

The next significant revelation was the data of McClure, Hanson and Hoffman, working at the University of Texas at Dallas, who published some results in 1977 taken from ion density probes on board the equatorial orbiting satellite AE-C (2). This satellite flew in a near equatorial orbit and showed a wide range of holes, or bubbles, in the ionospheric plasma typically 100 km in width and having plasma density reduced by 10 to 1000 times the background level. The fact that many of these holes rise up engendered the use of the word 'bubbles' and indeed the theory has been developed often with the aid of the analogy with air bubbles in water.

Bananas or spheroids?

One thing that the theoreticians are agreed upon, in a maze of general uncertainty about bubble growth, is that the bubbles must faithfully extend along the magnetic field lines right across the equator as depicted in Figure 2. This must be so, because diffusion time constants parallel to the magnetic field in the ionosphere are much less than a second, whereas horizontal drifts and vertical rises across the field (Figure 1) are measured in tens of minutes.

The concept of elongated bubbles has been verified experimentally by Dyson and Benson (3) and by Heron and Dorling (4). Peter Dyson, a Melbournian, has even dared to suggest that the word "bananas" be used to describe the bubbles. In his defence it should be said that the banana image needed to be argued to dispell the false concept of oblate spheroids as in air-in-water bubbles. And this shape question has most important consequences in transequatorial VHF propagation.

Symbiosis of theory and experiment

Before we think about propagation, interference and the rash of transequatorial two metre QSOs, we should note the interaction to and fro between theory and experiment.

Very quickly after the initial experimental data, a flurry of theoretical modelling and prediction began (5, 6) so that now, some three years later, we have models of fully field-aligned depletions in plasma density, moving upwards (at the equator) as time proceeds and drifting eastwards (7). In fact, the theories have predicted more than the currently known observations and since they don't all agree it is now the experimenters' turn for the next move.

Specifically, we need to have observations of the growth and decay of individual bubbles to be able to test the theoretical time histories, and also we need more observations of the ionospheric conditions which allow bubbles to form on some nights but not on others.

One approach which allows a path for interaction between theory and experiment was the numerical modelling by the author and Leo McNamara of the Ionospheric Prediction Service in Sydney (8). The idea was to treat individual bubbles as ducts for radio wave-guiding so that if a transmitter (at VHF) had a line-of-sight access to the end of a bubble then energy may be directed into a certain prescribed geographical region in the other hemisphere. A "best model" for the bubble cross-section, height above the equator, plasma densities, and velocities both upwards and eastwards was synthesized from the most reliable theories and experiments and a numerical study of the possible transequatorial propagation paths was done on the NOAA CDC-6600 computer in Boulder, Colorado in 1978.

The resulting paramaters of frequency dependence, latitude dependence and Doppler shifts agreed well with the published record of transequatorial propagation and gave some confidence to the assertion that VHF transequatorial propagation in the evening is via these bubble waveguides. While relative powers on the TEP link agreed with observations, the absolute power levels predicted by this numerical model were far too high. Clive Winkler of DSE at Salisbury is following this up by applying some concepts of wave-guiding in optical fibres (9).

Where from here?

We have enough accumulated wisdom to be able to take another step. Let's reiterate:

(i) the plasma bubble phenomenon was discovered experimentally;

(ii) theoretical studies have explained the

general formation of bubbles but do not agree too well about the growth and movement;

(iii) numerical models relate VHF transequatorial propagation to bubbles.

The next step is to use VHF transequatorial observations to shed light on the detailed growth and movement of individual bubbles. This will allow the theoreticians to go through another cycle of refinement. Ultimately one would hope that the phenomenon and its ramifications in communications will be understood to the point where it is predictable — at which point we can use it (TEP contacts), abuse it (intertropical interference), or avoid it (VHF scintillation on satellite communications) as we see fit.

The role of the amateur

Amateur radio operators on the two metre band have already made a contribution to the development of ideas which form the current knowledge of equatorial plasma bubbles. The transequatorial QSO reports, for example, support the banana shape and also indicate the integrity of the bubbles right across the interhemispheric connection, as opposed to the idea of unconnected 'spread-F' or "scintillation" irregularities. QSO logs have enabled some degree of evaluation of the size of the conjugate region typically available for potential two metre contacts.

On a limited study (we would like more QSO logs) it seems that a receiver within 1000 km of the magnetic conjugate point of a transmitter on two metres has some chance of a contact. The conjugate point needs to be accurately calculated from magnetic field tables rather than from any dipole model.

Jurgen Rottger of the Max-Planck Institut für Aeronomie in West Germany has produced some graphs of S-meter readings plotted against time every minute by SV1AB in Zimbabwe-Rhodesia and ZE2JV in Greece during contacts.

The two metre transequatorial openings lasted typically 40 minutes to one hour which agrees reasonably well with the concept of moving ducts. An important implication is that some properties of individual bubble waveguides can usually be observed without interference from nearby bubble structures. Occasionally, a double-peaked power curve suggested closely spaced ducts.

Such power level graphs and even QSO reports alone are useful for basic statistics but the potential for involvement of radio amateurs on two metres now extends further. There is the possibility of using direction-finding techniques to locate the point on the base of the ionosphere where the interhemispheric duct terminates. If the bubbles do indeed move eastwards and do rise upwards at the equator whilst remaining field-aligned, then the duct termination should move eastwards and appear higher and higher above the horizon. Observations of azimuth and elevation angle of arrival at one minute intervals are required to check

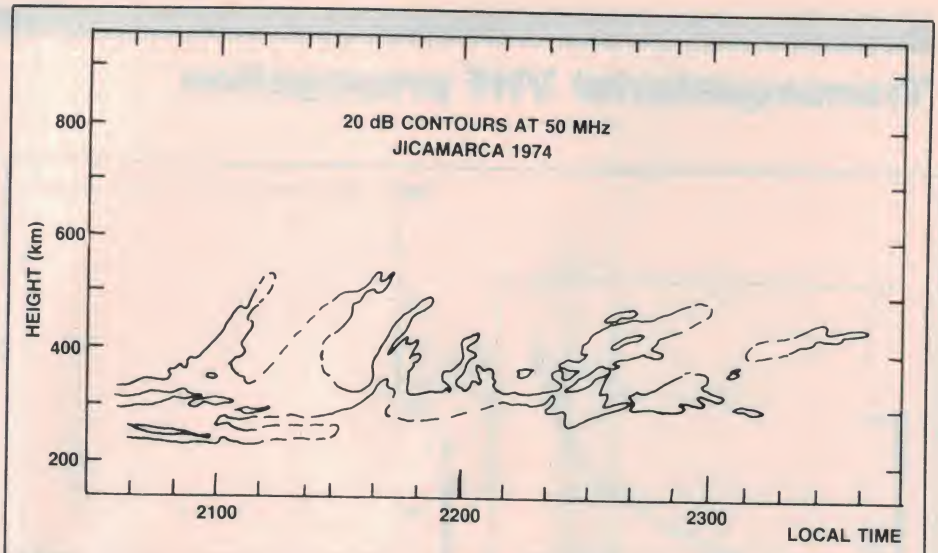


Figure 1. 20 dB contours of the backscatter power from small scale F region structure on the 50 MHz Jicamarca radar. The broken lines are interpolated sections. After Woodman and La Hoz (1976).

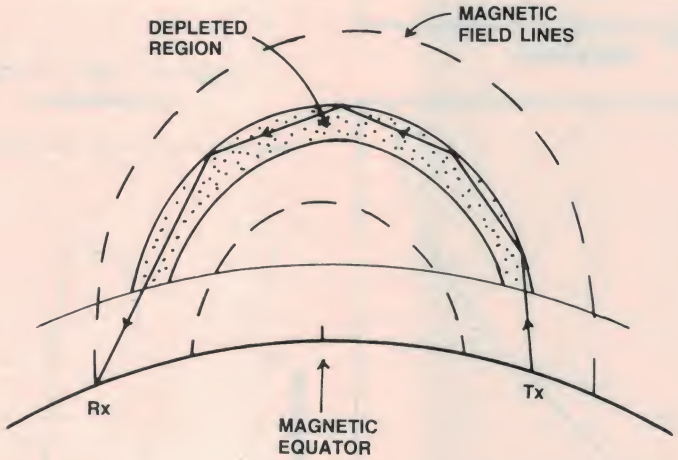
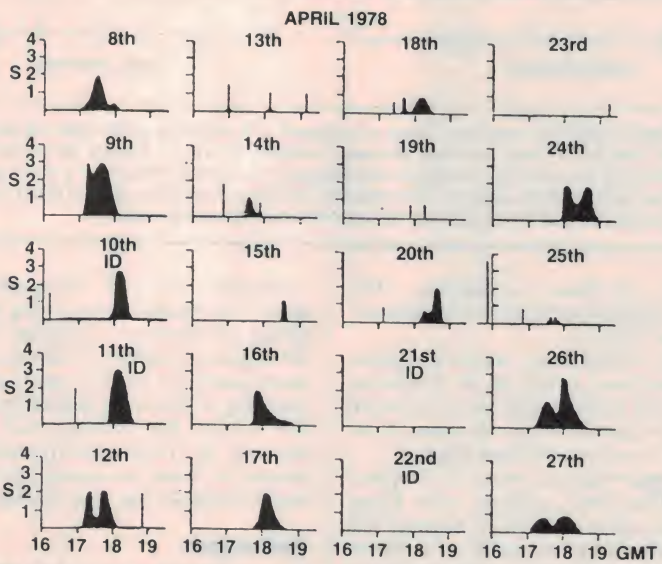


Figure 2. The wave-guide structure of the field-aligned inter-hemispheric equatorial plasma bubbles.



Signal strengths versus time, 144 MHz. Jurgen Rottger's graphs of S-meter readings of reception from the ZE2JV beacon (144.118 MHz) at Salisbury, South Africa, by 5B4WR at Limassol, Cyprus, during April 1978. Double-peaked curves suggest closely-spaced ducts moving through the path.

Transequatorial VHF propagation

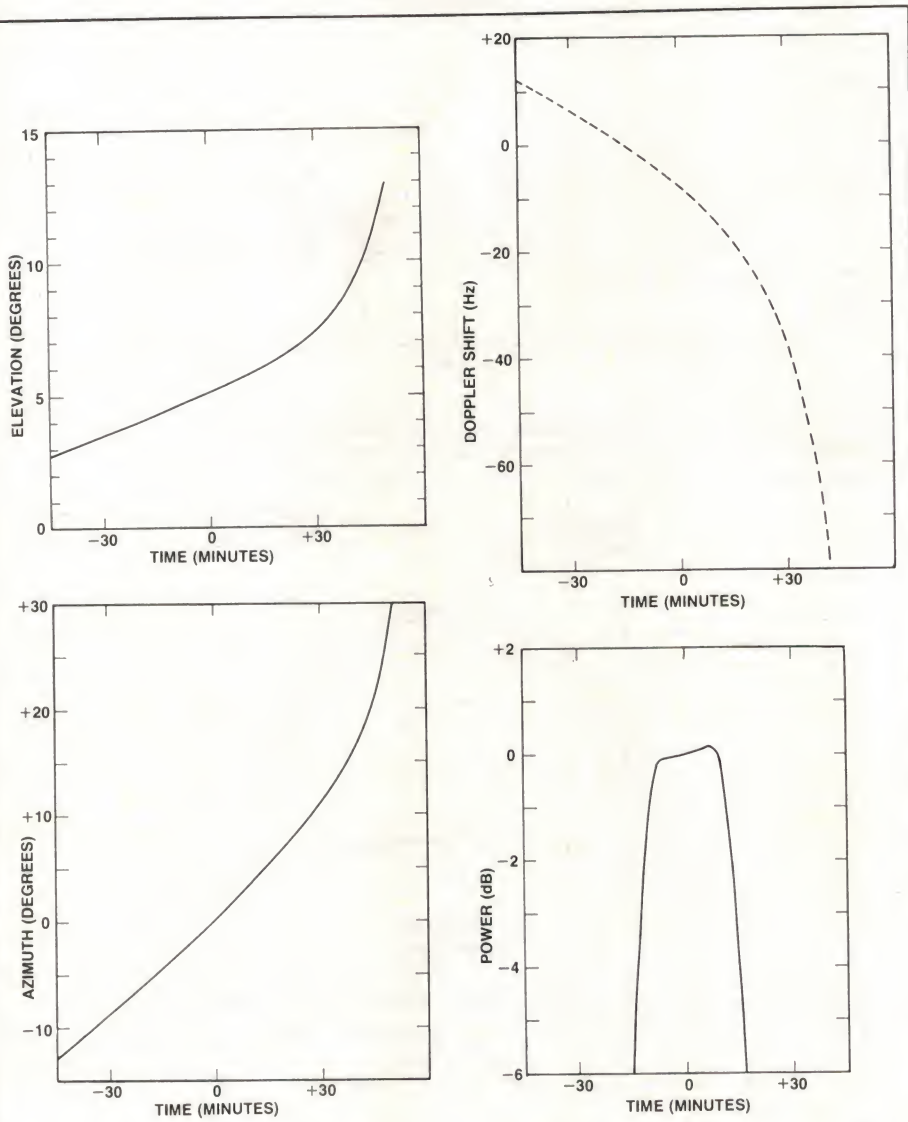


Figure 3. The type of azimuth, elevation, power and Doppler shift variations which might be observed from a conjugate VHF transmitter. Here we have assumed a bubble growth; in practice we would go from the observed parameters to specifying the bubble development. The time is taken from a zero value when the bubble is at the longitude of the receiver. The frequency for these calculations was 100 MHz and the bubble was assumed to be rising at the equator with an exponentially increasing velocity.

the theory of these movements. The expected variations of angle of arrival are indicated in Figure 3.

A further observation, which is a little more sophisticated, is that of the frequency shift due to the varying path length between a transmitter and conjugate receiver communicating along one of these ducts.

At the beginning of a contact the Doppler shift should be small, perhaps a few Hertz positive, and then over 30-40 minutes the Doppler shift should normally go negative to several tens of Hertz, if the theoretical dynamics are anywhere near correct.

The four observations of elevation, azimuth, frequency shift and power, if made accurately, can be interpreted via the numerical models to go a long way towards giving the behaviour patterns of the equatorial plasma bubbles. Unfortunately, many Australians are too far south, magnetically speaking, to be in the action, but the Northern half of the country, and particularly west of the Gulf of Carpentaria, is well placed for Asian conjugate stations. Darwin and Yamagawa are very nearly conjugate.

Epilogue

It is interesting to spectulate on two points. One is that this phenomenon was due for a rapid development because of technological moves. If the two metre activity explosion had occurred before the last sunspot maximum then the discovery of the propagation mode may well have been made by radio amateurs. The second point is a challenge. The Jicamarca record shown in Figure 1 clearly shows the bubble phenomenon. It was made in 1974, very near sunspot minimum. Are we kidding outselves that the two metre path through equatorial plasma bubbles is restricted to high sunspot epochs?

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You might also refer to: Harrison R. (1979), *Investigations of long-distance VHF/UHF amateur contacts across the geomagnetic equator*, Proceedings of the 1979 Symposium on Future Amateur Communications Techniques (available from the author). ●

This article is reprinted from Proceedings of the 1979 Symposium on Future Amateur Communications Techniques. Despite its age, it remains relevant, especially in view of the huge number of two metre contacts across the equator recorded in the intervening years. Anyone interested in submitting logs for study should contact the Editor of ETI at P.O. Box 227, Waterloo NSW 2017. (02)663-9999.

MINI-MART

For Sale/Wanted/Swap/Join

AUDIO

FOR SALE: PLAYMASTER speakers. Large 70 litre cabinets, 3-way, 300 mm woofers. High and mid-range faders. Showroom condition. Cost $374, sacrifice $240. Brian Proctor, (02)579-6867.

FOR SALE: 100 W SPEAKERS in two cabinets. $6000 ono. (062)86-2475.

MISCELLANEOUS

FOR SALE: OSCILLOSCOPE, Trio CS1830, dual trace, delay triggered, dc-30 MHz. As new with three probes, manual and service manual, $1000. (053)34-7630.

FOR SALE: OSCILLOSCOPE, 60 MHz Tektronix 2213, mint condition. $1400. Digital multimeter, Beckman 3010, as new, $150. R. Coleman, 7 Mallee Place, Rivett. 2611. (062)88-5369.

FOR SALE: B&W 12" GENERAL monitors receivers. High resolution video in, professional conversion brand new sets surplus to needs. $108. (08) 264-3073.

WANTED: 'EVERYDAY Electronics and Computer Projects', September 83 or a photocopy of Part 3 of 'Microcomputer Interfacing Techniques'. B. Le Marshall, 6 Exchange St, Ballarat Vic 3350. (053)32-2793.

FOR SALE: TELETYPE MODEL 15 with 240/110 Vac transformer, EA computer interface and manual $70. N. Frencken, Mt Waverley Vc. (03)606-8046 bh. (03)277-4478 ah.

COMPUTERS

FOR SALE: SUPER 80 computer, 48K RAM, BASIC on tape, Editor-assembler, debugger-disassembler, graphics, in case, basic and technical manuals, BASIC programs (book), $300 ono. (053)34-7630.

FOR SALE: MICROBEE software, 'Gorge of Death' real time graphics adventure for 32K machines. $10 including tapes and instructions. G. Swan, 20 Cashel Cres, Killarney Heights NSW 2087.

FOR SALE: S100 16K 150 nsec static memory boards (two off) supports Phantom addressing. $120 each. Peter Kay, 140 Watsons Rd, Glen Waverley Vic 3150. (03)560-5453 bh. (03)44-0791 ah.

WANTED: INFORMATION about the Mini-Scamp. Details of the hardware and software would be appreciated. Write to F. Testi, c/-A. C. K. Kilmore Vic. 3601.

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FOR SALE: OSBORNE 1, dual single density drives, 64K, CP/M 2.2, Wordstar/Mailmerge, Supercalc, CBASIC/MBASIC, manual. As new condition for $1190. David (02)516-9528 bh.

FOR SALE: SUPERMON, the Aussie monitor for Atari 400/800. Full disassembler functions such as List, Trace, Move, Change etc. Full disk controller, four more graphics modes from BASIC, seven splitscreens. Most revision B features, some XL. Many more functions, requires no extra memory, $89. W. Visser, P.O. Box 507, Beenleigh Qld 4207. (07) 209-7891.

FOR SALE: SUPER 80, 48K, EPROM BASIC, S100 expansion monitor and cassette recorder. All as new, $500. (02)887-3148 ah.

WANTED: IBM keyboard in any condition, disk drive and monitor. Wayne (02)668-9616.

FOR SALE: NEC COLOUR APC. 2x1MB drives, 256K, 8086. Hi-res graphics sub-system and development software. Various highly useful disks. Warranty until end of June. $6900. M. Mowbray. (02)230-5438 bh. (02)923-2974 ah.

FOR SALE: MICROBEE personal communicator (32K), software, documentations; Mitsubishi SV-1290X VDU; all one month old for $675. Mr Lim, 9 Malua Cres, Mill Park Vic. (03)404-2063.

FOR SALE: HITACHI MB6890 (Peach) microcomputer system 48K RAM, colour monitor (hi-res), DSSD disk, tractor printer, 20 disks with programs, lots of documentation. Cost $5200, sell $3250 ono. David Morton, 26 Myrtle St, Murwillumbah NSW 2484.

FOR SALE: SYM-1, CASE and power supply, full ASCII keyboard and 64x28 video board (128 characters in EPROM) with drivers auto linked in EPROM. $250 ono. Rob. (053)30-1524 ah. Ballarat.

FOR SALE: S100 boards. Static RAM, 64K, 8 MHz, extended addressing, phantom disable, EPROM substitution. Four boards, each $375 or $1400 the lot. East Ryde. (02)888-7624.

FOR SALE: BIG BOARD2 chess program, Sargon derivative using BB2 graphics on 8" CP/M disk. D. Craig, 2 Bridle St, Mansfield Qld. 4122. (07)349-9719 ah.

FOR SALE: MICROACE computer, 2K RAM, direct video, power supply, software, information (newsletters etc), excellent condition, $130 ono. (07)209-7841 ah.

WANTED: ADDRESSES of suppliers of software/hardware for the System 80 computer. Contact Mr R. Schatz, P.O. Box 17, Koorawatha NSW 2807.

WANTED: OSI C1P disk drive with OS65D and D. T. disk interface board. Also OS65D manual and software. J. Barnes, 8/3A Montagu St, Hobart Tas. 7008. (002)31-0414.

MICROBEE USERS: FREE newsletter with program hints, handy hints etc. available for the asking. To register for your inclusion in our mailing program write to Tom Bontes, P.O. Box 79, Gosnells WA 6110.

FOR SALE: DGZ80 CPU, MW640 VDU, 48K CMOS RAM,. RCA keyboard, 10-slot 10A frame, tape I/f. Tapes: BASIC, EDASM, Pilot, etc. $700. G. Harrod, (07)378-8534.

WANTED: APPLE BOOKS, especially 'Beneath Apple DOS', Apple magazines (In-Cider, Softalk, Orchid, etc.), Apple software (games, utilities, etc). Rom (02) 217-2434 bh.

FOR SALE: Z80 DEVELOPMENT system Tec-1, by Talking Electronics $90 ono. complete with manuals and power supply. Mark (02)872-3407.

FOR SALE: S100 boards 16K static RAM $115, 64K dynamic RAM $295, I/O board 25 & 9P $240, disk controller & CP/M $399. (07)30-1949 after 6pm.

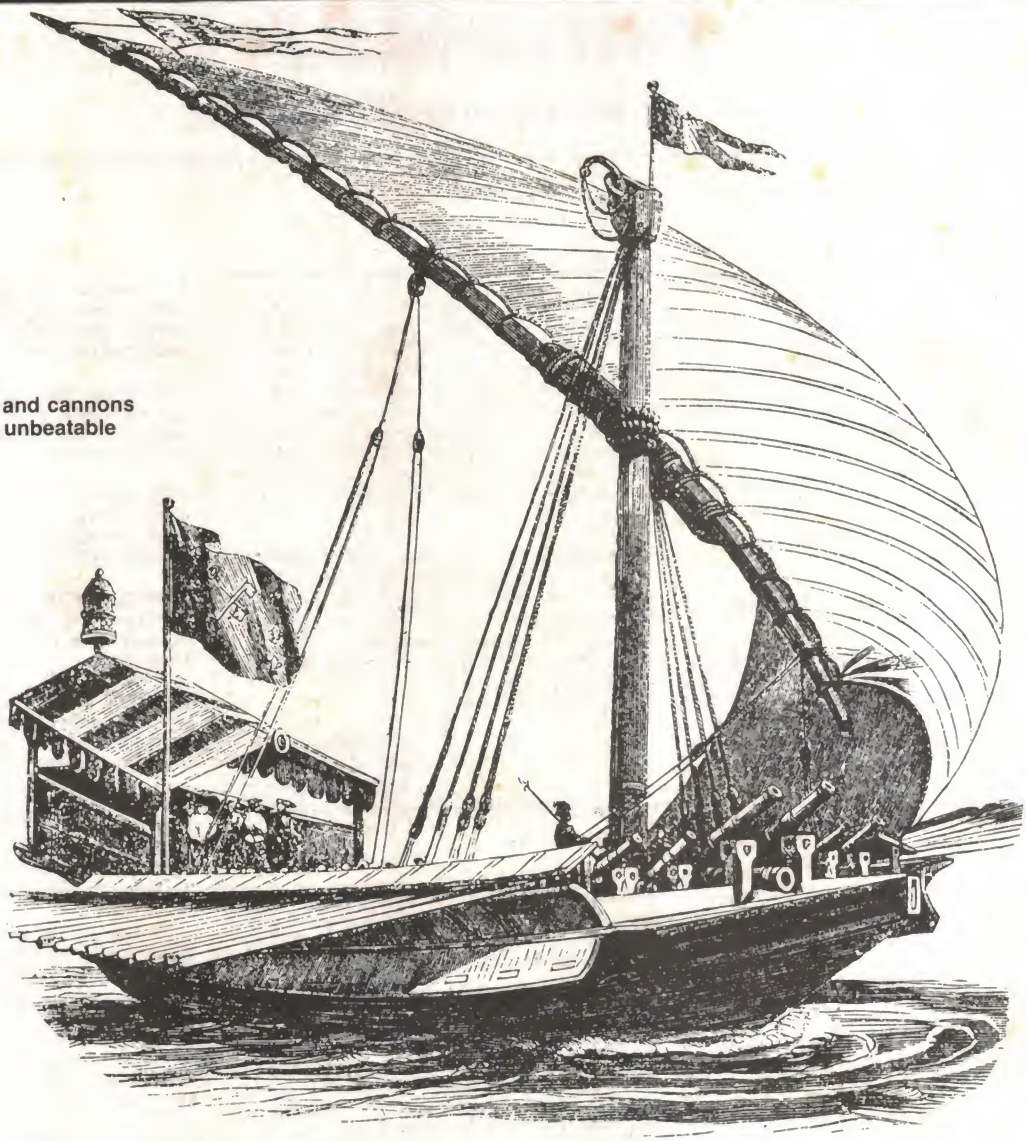
FOR SALE: SEKONIC printer plotter S200-GP. As new condition with one roll of paper. Centronics interface. $550 only. W. Fiala, 21 Hallows St, Glen Waverly Vic. 3150. (03)232-0713 ah. (03)758-9000 bh.

ACT VIC-20 bimonthly magazine: Many interesting articles and programs. April issue $2. Bimonthly $12 per year. Chris Groenhout, 25 Kerferd St, Watson ACT 2602.

COMMUNICATIONS

FOR SALE: PHILIPS FM 320 UHF transceiver and 10 ft co-linear. $280 ono. (062)86-2475.

FOR SALE: DICK SMITH 40 channel UHF transceiver. Built and tested. S meter and repeater options. Selling due to unfortunate geographical location. $225 VK5BCD (085)22-5241.



. . . wings on the keel and cannons on the foredeck — an unbeatable combination!

DREGS

GATHERED RECENTLY, in that other Apple Isle across the Big Pond, were a score of technical journalists from around the world — including ETI's correspondent Collyn Rivers. All were there for the pre-release of an exciting new computer.

All went well until Murphy intervened — during a demonstration of the ease with which the machine could access data-bases. Three successive attempts failed — a happening which should neither surprise nor dismay anyone who's ever experienced the sheer inanimate malevolence of computers in midsulk.

In retrospect, the hapless demonstrator should have retired wounded (or acquired some more haps), but he pressed on with the demo — which from then on went well.

Until question time.

Then a British journo (arrogant, even for a Pom) asked how come the machine was the ultimate in user-friendliness when even experts couldn't make it work. The demonstrator rose to the bait and asked what on earth the questioner meant.

"Stuffed it three times in a row, didn't you," said our charmer.

"Now we know," observed Collyn upon his return, "what St John really meant in Corinthians 15:33." (For those unaquainted with apostolic aphorisms John 15:33 reads, 'evil communications corrupt good manners'.)

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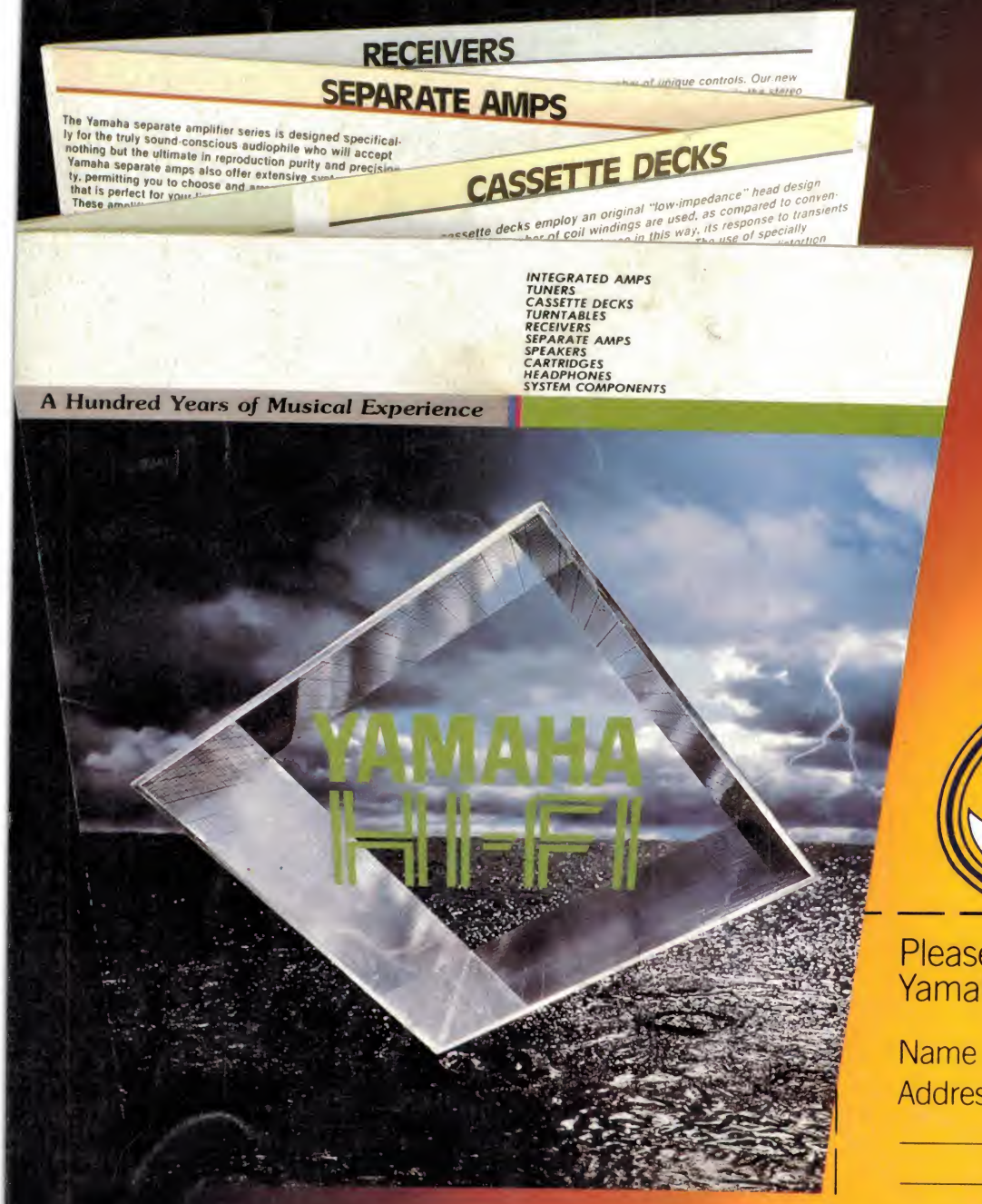

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